FORE SYSTEMS

Technical Education

ATM Core Switch

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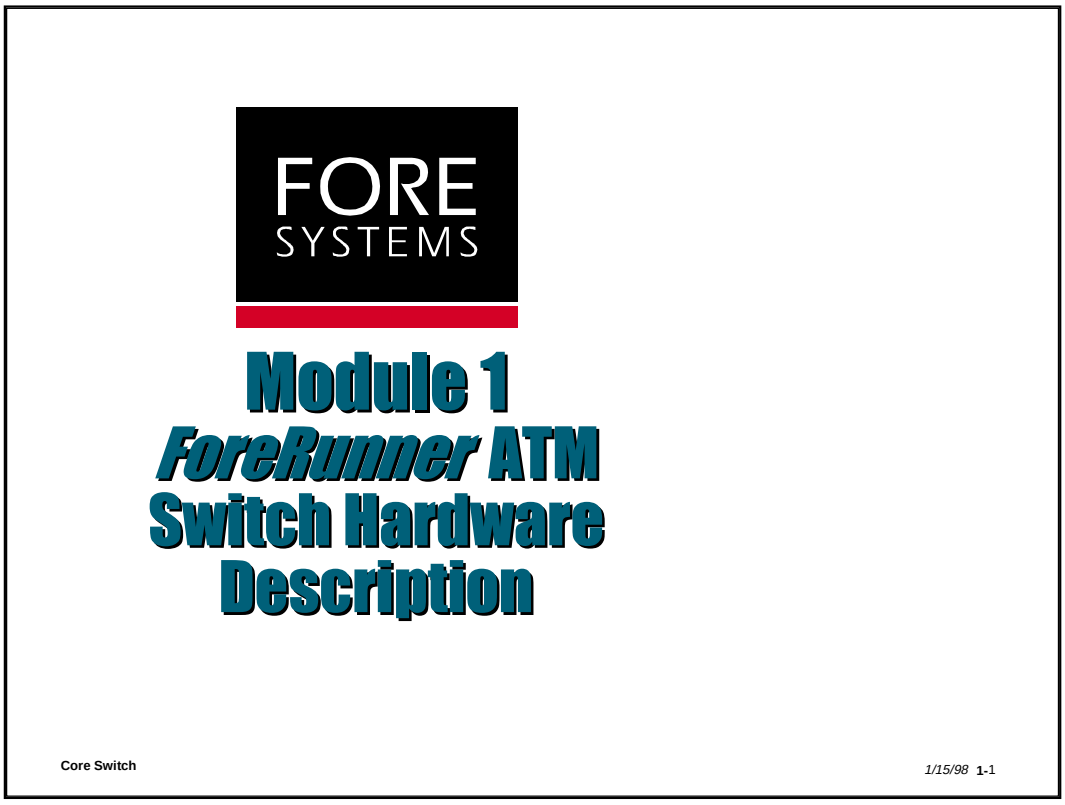
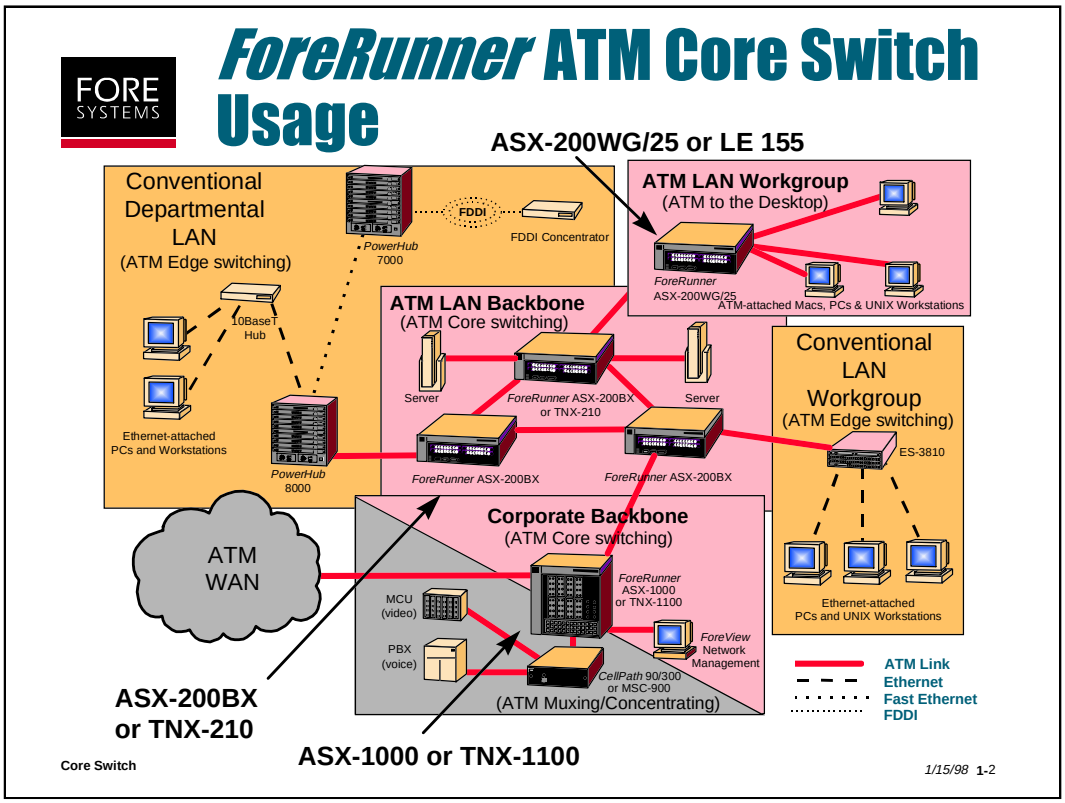




The *ForeRunner* switches are designed specifically to meet the unique needs of enterprise or Service Provider networks. All *ForeRunner* switches include non-blocking switch fabrics, a distributed, shared memory architecture, and advanced quality of service (QoS) features through *ForeThought* Bandwidth Management.

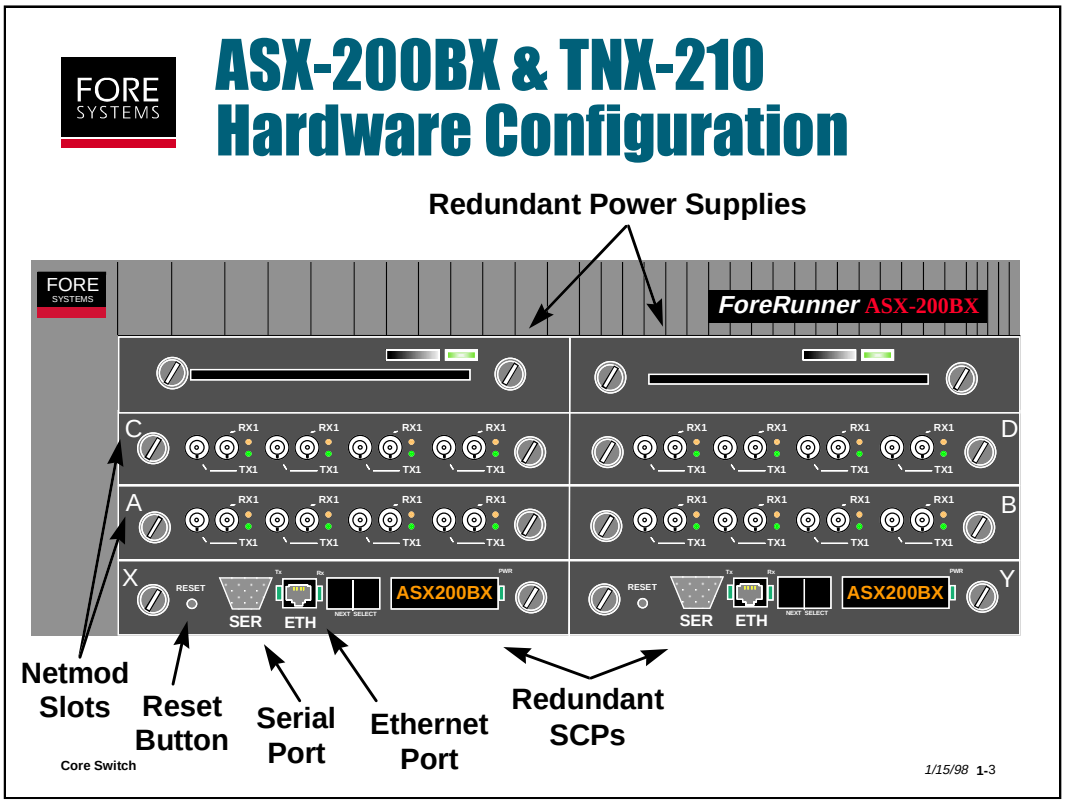
ForeRunner ASX or TNX switches and MSC concentrators provide modularity and scalability through an advanced family of ATM LAN and WAN network modules ranging in speed from 1.5 to 622 Mbps.

The switch fabric is a non-blocking, 64-bit, contentionless, Time-Division-Multiplexed (TDM) bus running at 40 MHz and providing 2.5 Gbps of bandwidth. FORE Systems' Contentionless Time-Division Switching fabric permits all input/output ports to transmit at their maximum rate without encountering blocking or congestion within the switching fabric. That's because the sum of all the network module ports' time slots cannot exceed the total capacity of the switch.

The capacity of FORE Systems' "Smart" output buffers ranges from 13,312 to 65,536 cells. FORE's high-performance network modules feature automatic and dynamic buffer allocation, per-VC queuing, packet level discard, and multiple service priorities. The *ForeRunner* ASX-1000 is also the first enterprise ATM switch to cross the threshold of over 1,000,000 cell buffers per ATM switch. These features are essential for effective bandwidth management when connecting high-speed LAN environments to lower speed WAN services.

FORE's Smart Buffers have the ability to automatically and dynamically allocate memory space based upon a connection's service level requirements. This dynamic allocation statistically increases the effective size of the buffers by 1.5 to 3 times, giving FORE's switch an effective capacity of almost 40,000 cells per port, or 75,000 to 150,000 cells per switch. Buffer capacity can also be statically allocated to some connections if the connection's service level requires it, as is the case with Constant Bit Rate (CBR) traffic.

Per-VC Queuing is a fundamental requirement for an ATM switch. It guarantees multiple levels of service and ensures that the switch performs packet level discard. Per-VC queuing provides a dedicated queue for each virtual circuit, with each network module supporting up to 12,000 virtual circuits. This allows the switch to distinguish between virtual circuits and to allocate to each virtual circuit its own output buffer. Because each connection is treated independently, each connection is serviced in turn according to its requirements.



The ASX-200BX or TNX-210 incorporates an i960ha or Pentium switch control processor. The primary SCP occupies the lower left (X) bay of the switch chassis. In dual SCP mode (standard for the TNX, optional for the ASX), the secondary SCP occupies the lower right (Y) bay of the switch chassis. The front panel of the SCP includes:

RESET - reset the SCP, perform a "warm" boot and initial power-on diagnostics. It is recessed into the faceplate to prevent accidental activation, and must be pushed with an object like a straightened paper clip.

RS-232 Port - provide terminal access to the SCP using a Dsub-9 pin connector (female for i960 and male for Pentium SCPs). A user logging into the switch through this port can de-activate other AMI sessions that may be running (via telnet, for instance).

Ethernet 10BaseT Port - provide out-of-band access to the SCP using standard Ethernet UTP RJ45 connector. There is a transmit LED to the left of the port and a receive LED to the right. The *ForeRunner* ATM switch User's Manual describes the LED states in detail.

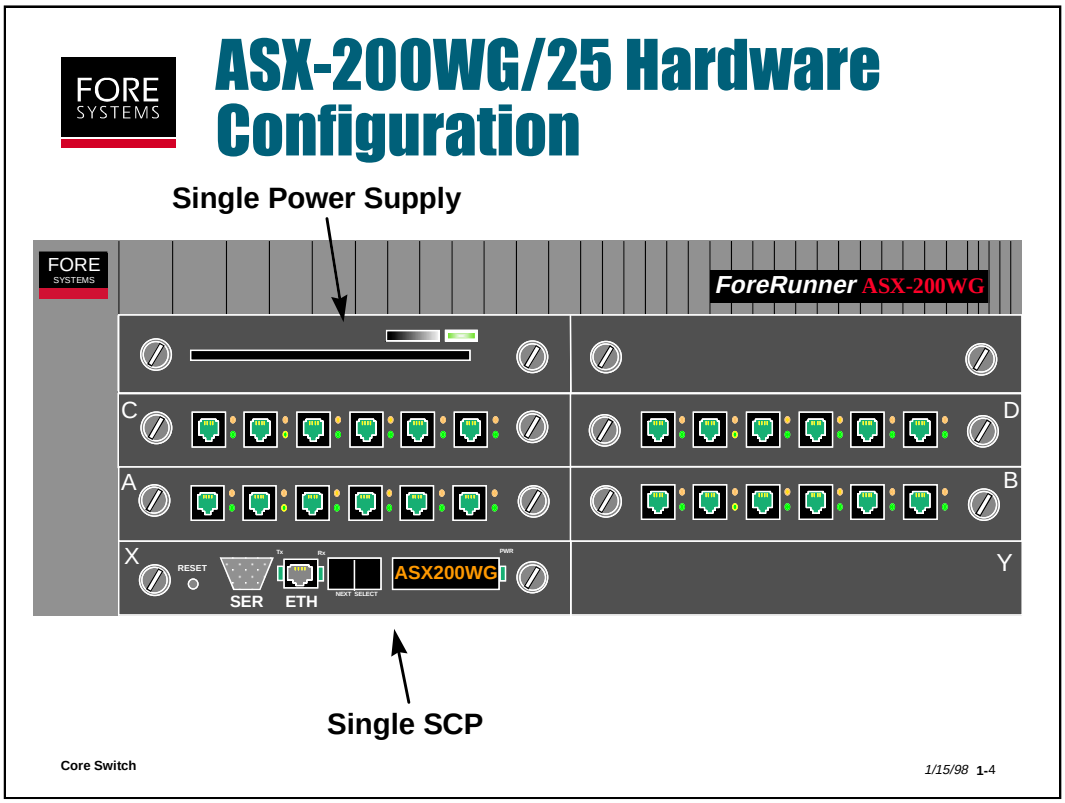
NEXT button - scroll through the menu on the display LED after the power is turned on and after the SCP is reset or rebooted.

SELECT button - choose menu option shown on the LED display after the power is turned on and after the SCP is reset or rebooted.

DISPLAY LED - show initial power-up diagnostic messages during boot process. After booting, show user-defined switch name.

Power LED - red indicates that power is on, but that the SCP has failed diagnostic. Green indicates that the SCP has power and is in good status.

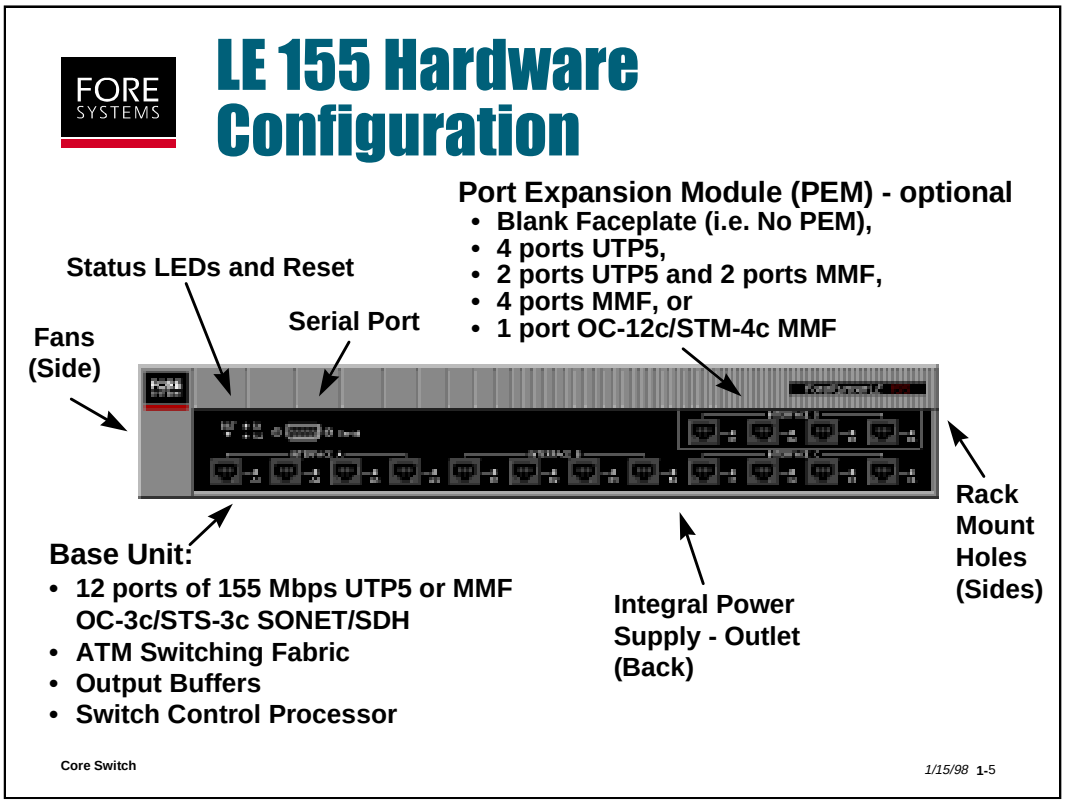
The ASX-200BX and TNX-210 incorporate dual load-sharing redundant power supplies (standard on the TNX, optional on the ASX). The On/Off switches for these power supplies are located to the right of each, along with an LED that displays the current power supply status. Red indicates power failure (input or output), and green indicates the power is OK (both input and output). The power supplies are located in the top left and right bays. They are hot-swappable, and each is capable of assuming the entire load of a fully populated switch.



The ASX-200WG/25 incorporates a single i960ha as the switch control processor (SCP), which can only be located in the lower left (X) bay of the switch chassis. The front panel of the SCP includes the same features, with the same functions, as the ASX-200BX when using an i960 processor: a RESET button, an RS-232 serial port, an Ethernet 10BaseT port, a NEXT button, a SELECT button, a display LED and a power LED.

The ASX-200WG/25 is wired only to accept a single power supply in the top left bay. The On/Off switch is located on the right of the power supply, along with an LED that displays the current power supply status: red for power failure (input or output), and green for power OK (both input and output).

The ASX-200WG/25 is available in two configurations, one with three 6-port 25Mbps netmods and one 4-port 155Mbps netmod, or a configuration with four 6-port 25Mbps netmods as shown above.



The LE 155 incorporates an i960cf as the switch control processor. The LE 155 is offered in a fixed configuration with 12 ports of ATM interfaces in either UTP5 or MMF 155Mbps SONET/SDH.

One optional Port Expansion Module (PEM) can also be included, as: a 4 port UTP5 ATM module, a 2 port UTP5 and 2 port MMF ATM module, a 4 port MMF ATM module, or a 1 port OC-12c MMF ATM module.

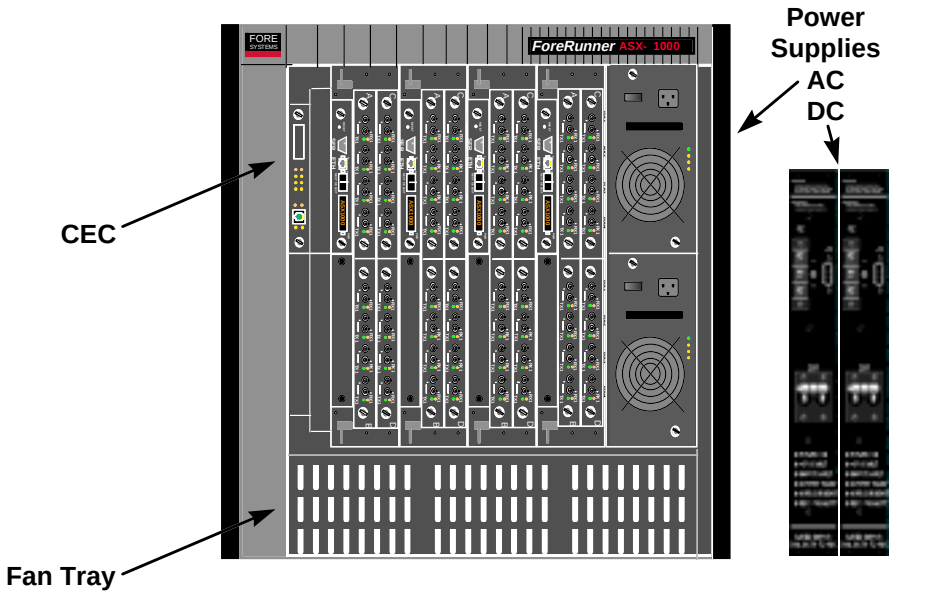
Note that the serial interface on the LE 155 is a male Dsub 9 pin connector like the ASX Pentium switch series.

Note also that each port only has one LED associated with it. The LED will blink green for Tx and Rx traffic, yellow for receive side SONET alarms. and red for loss of signal (LOS).

Near the Reset button (same form and function as ASX series) are two LEDs labeled S1 and S2. S1's use is undetermined at this time, but S2 performs the same function as the power LED on the ASX series (flashes red during reset to indicate i960 self test and turns green upon successful completion/red for failure).

Notice that there is no Ethernet port, which eliminates the possibility of utilizing the ASX series Bootp method for recovering a loss of operating system. The LE 155 supports an xmodem serial boot capability.

ASX-1000 Hardware Configuration



Core Switch

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The ASX-1000 can have as many as four independent switching fabrics housed in a single chassis. Each fabric has the same features as the ASX-200BX with up to two i960ha or Pentium SCPs. If switching is required from one fabric to another, data can be transferred over an integrated shared backplane.

In addition, the ASX-1000 has a management station/interface in the far left bay called the Common Equipment Card (CEC) with these features:

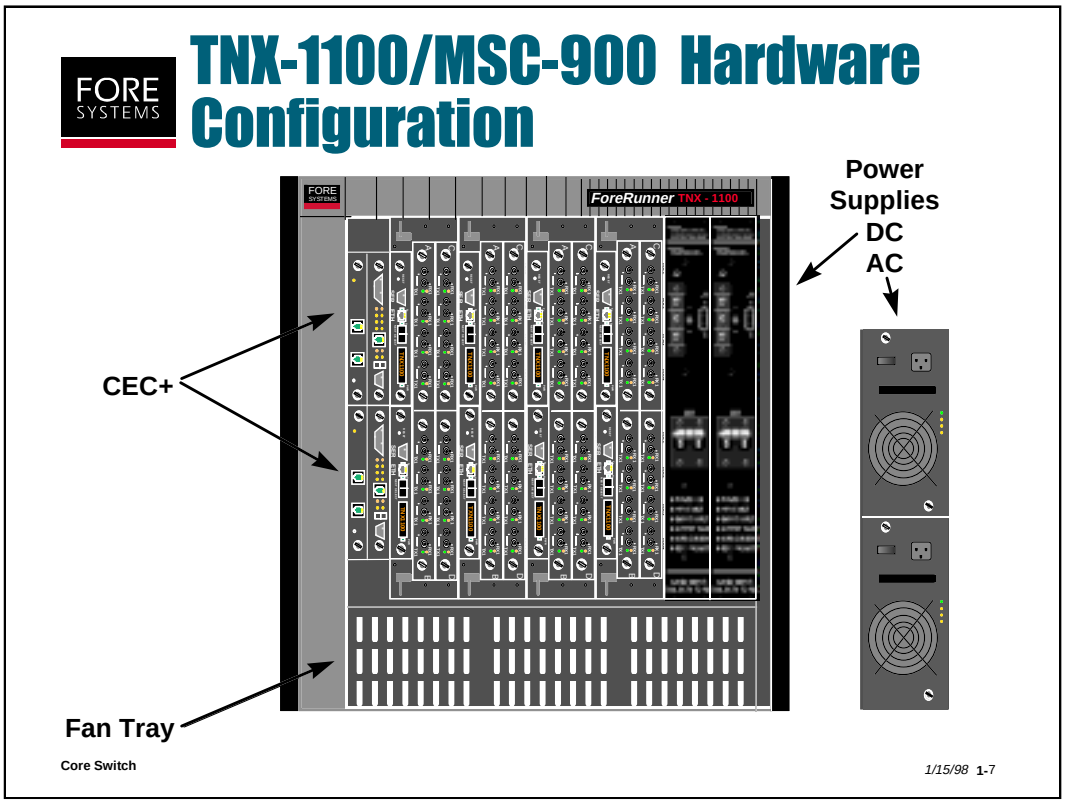
Alarm relay contacts - normally closed when there is no power to the switch. The user may attach alarm circuits to these contacts to trigger alarm LEDs (called AL1 and AL2) also located on the front of the management station, which can then be defined by the user as major or minor alarms. The actual cause of the alarm can be determined by using AMI.

Ethernet 10BaseT Port (standard RJ45) - supplied on the CEC to be used as a single unified Ethernet connection to all the SCPs installed in the ASX-1000. It is connected to each SCP via the backplane and simple Ethernet repeaters.

Power supplies - redundant, load-sharing, hot-swappable, either 120/240 VAC or -48 VDC.

Fan tray - hot-swappable. Be aware that swapping fans must be done quickly, due to the temperature sensor built into each switch board. If the temperature of the board exceeds 65 degrees Celsius, an environment alarm will trigger.

Major advantages of the ASX-1000 are the ability to hot-swap the switching fabrics and a unique distributed switching fabric architecture.



The TNX-1100 can have as many as four independent switching fabrics housed in a single chassis. Each fabric has the same features as the TNX-210 and comes with two i960ha or Pentium SCPs. If switching is required from one fabric to another, data can be transferred over an integrated shared backplane.

In addition, in the two bays on the far left, the TNX-1100 has redundant Common Equipment Card Plus (CEC+) cards for management station/timing input. They have: Stratum 3 or 4 T-1 or E-1 timing input/output, a D-sub 25-pin connector for alarm relay contacts, alarm LEDs for all fabrics, and an D-sub 9-pin connector and Ethernet connector for a common management interface.

Both the TNX-1100 and MSC-900 come with redundant, load-sharing, hot-swappable power supplies in either 120/240 VAC or -48 VDC, and a hot-swappable fan tray.

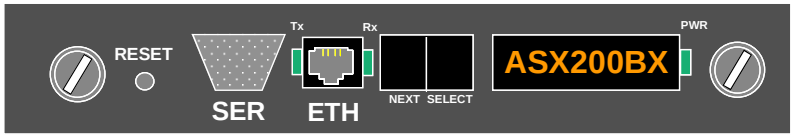
The MSC-900 is a fixed configuration concentrator subset of the TNX-1100 product. It must be configured with one slot used only for uplink purposes. Two additional slots can be also used as uplinks, or may be used for access. The potential uplink slots are slot A and B in fabric #1 and slot C in fabric #4. Uplink slots must contain OC-3c interfaces or greater (i.e. OC-12c).

The remaining 13 slots are used only for access. Access slots must contain DS-3 interfaces or smaller (i.e. DS-1). Placing an uplink netmod in an access slot causes an error message to be displayed.

Switch Comparison Matrix

Switches	**ASX-200WG/25**	**LE-155**	**ASX-200BX** **TNX-210**	**ASX-1000** **TNX-1100**	**MSC-900**
# of Ports	22-24	12-16	2-32	2-128	61-124
Processor	i960ha	i960cf	i960ha/P5	i960ha/P5	i960ha/P5
Intf. Rates 1.5622Mbps	25-155Mbps	155-622Mbps	1.5-622Mbps	1.5-622Mbps	
Sw. Band.	2.5Gbps	2.5Gbps	2.5Gbps	10Gbps	10Gbps
Timing	Yes	Limited	Yes	Yes+	Yes+
UNI 3.0/3.1	Yes	Yes	Yes	Yes	Yes
ILMI	Yes	Yes	Yes	Yes	Yes
NSAP/E.164	Yes	Yes	Yes	Yes	Yes
IISP/FT-PNNI	Yes	Yes	Yes	Yes	Yes
ATMF-PNNI	Yes	Yes	Yes	Yes	Yes
2 bucket UPC	Yes	Yes	Yes	Yes	Yes
Per-VC Queue	Yes	Yes	Yes	Yes	Yes
EPD/PPD	Yes	Yes	Yes	Yes	Yes
EFCI/ER	Yes	Yes	Yes	Yes	Yes
Cell Buffer/NM	up to 32K	up to 64K	up to 64K	up to 64K	up to 64K
QoS levels	4	4	4	4	4
FOREIP Intf.	1	1	1	4	4
CLIP Intf.	4	4	4	16	16
LANE Intf.	4	16	16	64	64
# LES/BUS	2	4	4	16	16
Hot Swap. NM	Yes	No	Yes	Yes	Yes
Hot Swap. Pwr.	No	No	Yes	Yes	Yes
Hot Swap. SCP	No	No	Yes	Yes	Yes
Hot Swap. Fab.	No	No	No	Yes	Yes
Hot Swap. Fans	No	No	No	Yes	Yes
DC Power	No	No	Yes	Yes	Yes
Dual Feed AC	No	No	Yes	Yes	Yes

Switch Control Processor



Core Switch

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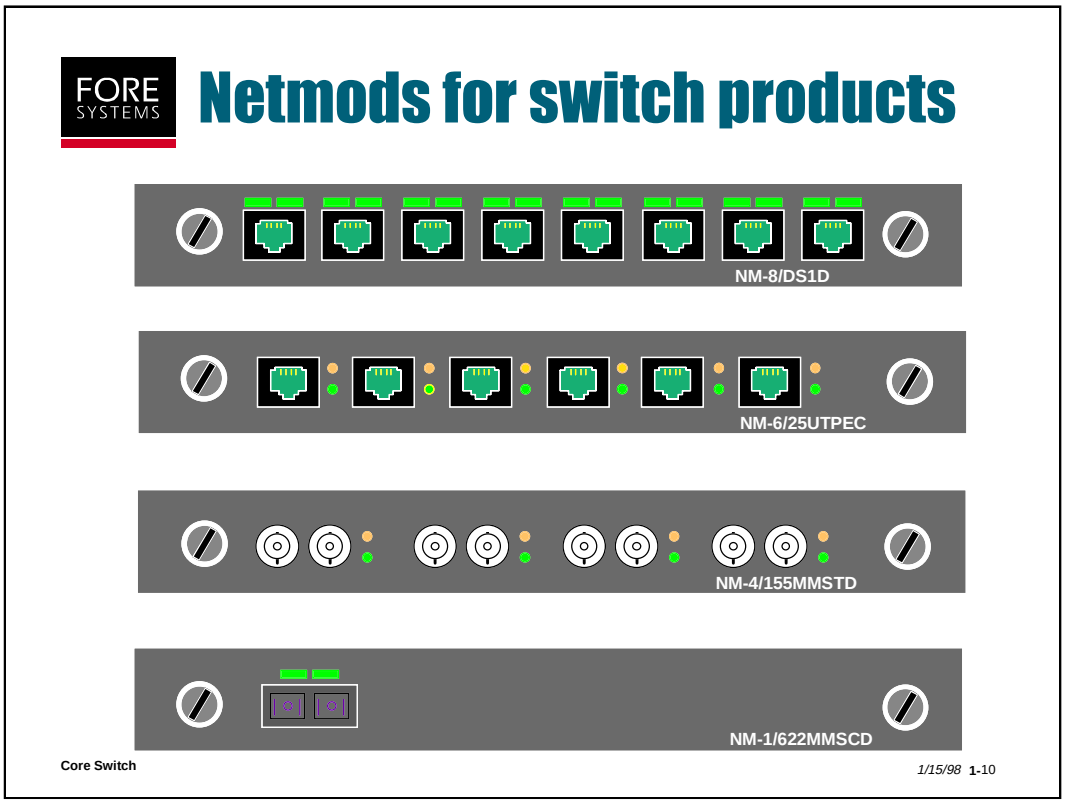
The Switch Control Processor (SCP) is available as an i960-based processor or as a Pentium-based processor. The i960ha is used as the ASX-200WG/25 processor; the i960cf is found in the LE 155. The i960ha is also the standard SCP for the ASX-200BX/TNX-210 and ASX-1000/TNX-1100/MSC-900. The Pentium-based SCP is an option for all ASX and TNX switches.

Each SCP type supports a unique combination of Flash and RAM:

ASX-200WG/25	i960ha	4M Flash / 16M RAM (single only)
LE 155	i960cf	3M Flash / 16M RAM (not swappable)
ASX-200BX & ASX-1000 (standard)	i960ha	4M Flash / 16M
ASX-200BX & ASX-1000 (optional)	i960ha / Pentium	4M Flash / 32M RAM (i960ha) 8M Flash / 64M RAM (Pentium)
TNX-210, TNX-1100 & MSC-900 (standard)	i960ha	4M Flash / 32M RAM (TNX comes with two, MSC with one)
TNX-210 & TNX-1100 (optional)	Pentium	8M Flash / 64M RAM

The LE 155 contains an i960cf, but does not have an Ethernet connection, Next or Select buttons, or a display as shown above.

For dual SCP operation, both SCPs must be either i960ha or Pentium.



Notice that the name of each particular netmod is printed on the lower right corner of the netmod. All netmods will physically fit in any netmod slot of an ASX-1000, ASX-200BX, ASX-200WG/25, TNX-1100, TNX-210, or MSC-900, but certain restrictions may apply (i.e. uplink netmod will not work in a pure access slot of an MSC-900). The LE 155 does not use netmods because it has a fixed configuration. There are three different series netmods available (C, LC, and D), each with different properties, which are detailed on the following page.

The complete line of netmod interfaces ranges from DS1 (1.544 Mbps) rates to OC-12c (622 Mbps) rates and comes in a variety of port configurations including 1-port, 2-port, 4-port, 6-port and 8-port. Connectors range from RJ45 to ST to SC. A common way to remember SC is "stick and click connector," and the ST for "stick and turn connector" (bayonet-type).

LEDs can be configured for a variety of purposes, but generally, green indicates traffic or carrier present, red indicates no connection or carrier, and yellow generally indicates some sort of generic SONET alarm.

For all netmods, port numbering starts at the left and each individual port is referenced by board (switch board), then slot and then port number, so…1a3 = board #1, slot a, and port #3

3c6 = board #3, slot c, and port #6.

Netmod Comparison Matrix

Netmods	Series C	Series LC	Series D
Interfaces:			
OC-12c	MM, SMIR	MM, SMIR	MM, SMIR, SMLR
OC-3c	UTP, MM, SMSR, SMLR	UTP, MM, SMIR	MM, SMIR, SMLR
DS3	Yes	No	Yes
E3	Yes	No	Yes
ATM25	Yes	No	No
J2	Yes	No	No
E1	Yes	No	Yes
T1	Yes	No	Yes
Cell Buffers:			
dependencies	memory model	VC counters off	none
size in cells	2,048 (ATM25) 10,240 (others)	32,768 (OC-3c) 65,536 (OC-12c)	32,768 (all)
Connections:			
dependencies	memory model	memory model	fixed with 8 counters/VC & /port
Unicast max	11,264	6,144	12,288 (OC-3c, OC-12c) 10,240 (DS3, E3, E1, T1)
Multicast max	1,024	512	1,024 (OC-3c, OC-12c) 512 (DS3, E3, E1, T1)
QoS Support	UNI 3.1 CBR, VBR, UBR	UNI 3.1 CBR, VBR, UBR	UNI 3.1 CBR, VBR, UBR
	UNI 4.0 CBR, nrtVBR, UBR	UNI 4.0 CBR, nrtVBR, rtVBR, ABR, UBR	UNI 4.0 CBR, nrtVBR, rtVBR, ABR, UBR
Buffer Mgmt.	EPD/module	EPD/module (UBR & CBR/VBR)	EPD/module (UBR & CBR/VBR)
	CLP1/QoS/port	CLP1/QoS/port	CLP1, CLP01/QoS/port CLP1, CLP01/VC/QoS
Scheduling	3 WRR QoS & priority/QoS	3 WRR QoS CBR & W/rest	3 per VC(smoothed, guaranteed, round robin)
Shaping	VP (1 per port)	none	VP and VC
Port stats	4	4 per QoS	7 per QoS
Conn. stats	none	2-4 per VC	7 per VC

Power Supply Modules

	ASX-200BX	ASX-1000	ASX-200WG/25	LE 155	TNX	MSC
HOW MANY?	1-2	1-2	1	1	2	2
AC or DC?	either	either	AC	AC	either	either
HOT SWAP	Y	Y	N	N	Y	Y

- **Any one power supply will power the entire switch**

Core Switch

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The ASX-200BX and ASX-1000 switches may be ordered with up to two load sharing redundant power supplies in an AC or DC configuration. The TNX-210, TNX-1100 and MSC-900 come standard with both these redundant supplies. The supplies have true load-sharing ability, with each capable of powering the entire switch. The supplies are hot-swappable for ease of maintenance.

The ASX-200WG/25 and LE 155 each comes with only one AC power supply.

ASX-1000/TNX-1100 Unique Components

- CEC/CEC+ Module
- Power Supplies
- Fan Tray
- Switch Board/Fabric Swapability
- Inter-Fabric Link Simplicity
- Inter-Fabric Timing Capability

Core Switch

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The ASX-1000, TNX-1100 and MSC-900 have several unique components, as listed above and detailed on the following pages.

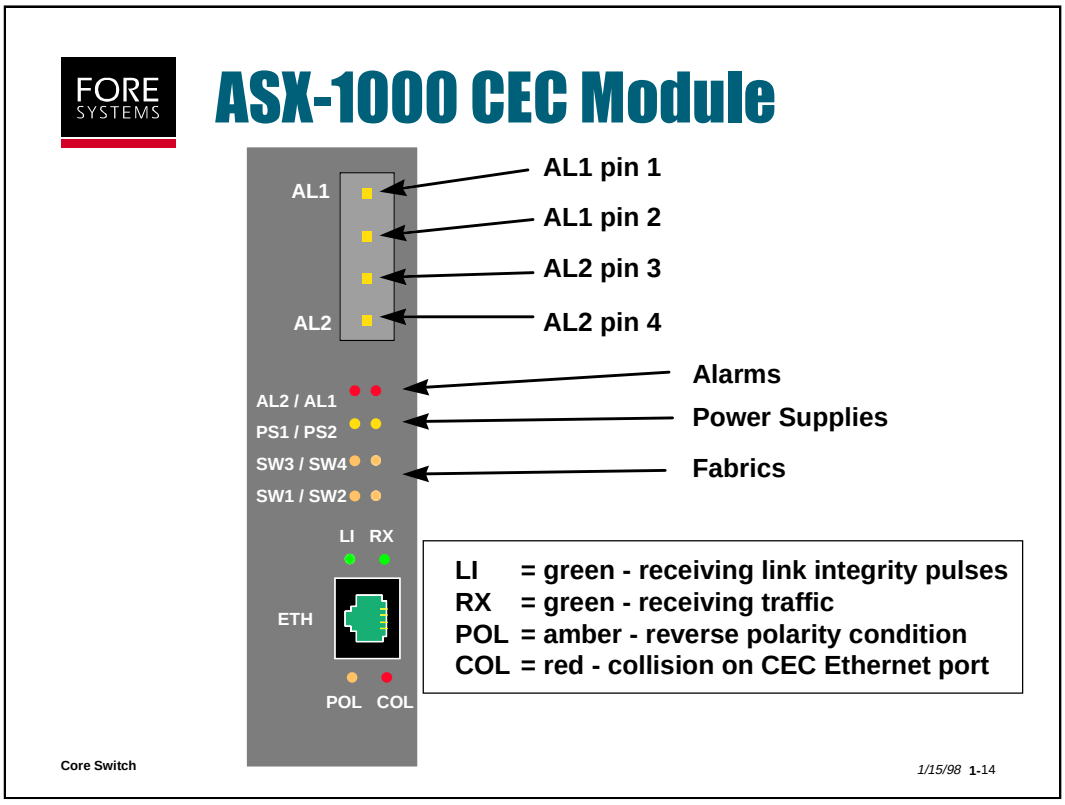
The CEC+ or Common Equipment Card (Plus) provides several functions to support the multiple switch fabrics that may exist in one chassis. Instead of each SCP in each fabric using its own Ethernet connector, the CEC+ provides a single Ethernet connector to a common management station. The CEC+ also provides alarm indications for malfunctioning fans or overheated power supplies and fabric enclosures. The CEC+ also adds the capability of obtaining common timing input from an external clock source to synchronize multiple fabrics/switches.

The power supplies of the ASX-1000, TNX-1100 and MSC-900 are unique because they can supply power from either an AC or DC source to up to four switching fabrics.

Because of the multiple switching fabrics, and separate power supplies, cooling is provided by a fan tray which takes in cool air at the bottom and blows it up through all the components.

These switches are also unique in their ability to allow hot-swapping or the addition of complete switching fabrics.

The backplane allows inter-fabric connection and timing distribution without the need for physical cables.



The four pins at the top of the CEC are used as alarm relay contacts for AL1 and AL2 alarms:

- Pins 1 and 2 (AL1) are jumpered together when no power is applied or in the event of a major alarm (fan failure, over temperature condition or power supply failure).
- Pins 3 and 4 (AL2) are jumpered together when no power is applied or in the event of a minor alarm (SPANS or link failure).
- Both sets of pins remain open when no alarm conditions are present.

There are eight LED indicators:

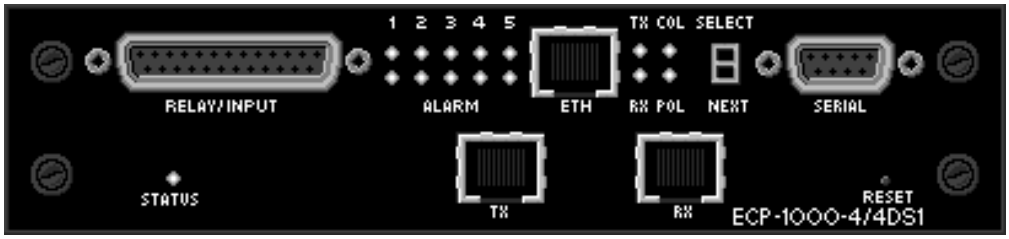
- The top two LEDs just below the alarm relay contacts light to indicate a major (AL1) or minor (AL2) alarm.
- The second two LEDs illuminate yellow to indicate a good power supply (they are out if the supply is bad).
- The bottom four LEDs blink to indicate a functioning switch board. If they are on solid or out it indicates a fault condition.

The Ethernet connector is essentially a repeater for all of the SCP Ethernet connectors on each switch board, allowing one connection to a management station for multiple switch fabrics. Remember that each ie0 interface will have to have a unique IP address. LEDs indicate connection status.

Note that when detecting reverse polarity condition on the twisted pair CEC Ethernet connector, the condition is automatically corrected, but the LED remains lit until a corrected cable is inserted into the port.

TNX-1100/MSC-900 CEC+ Modules

- **ASX has only one CEC model**
- **TNX/MSC have 4 CEC+ models**
- **CEC+ adds 2 BITS inputs, hitless failover, 5 relays**



Core Switch

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TNX/MSC have four CEC+ flavors:

- T-1 Stratum 3
- T-1 Stratum 4
- E-1 Stratum 3
- E-1 Stratum 4

A CEC+ consists of:

- Frame (card-carrier and passive backplane interface)
- Timing Control Module (TCM)
  - Environmental Control Processor (ECP) +
  - External Synchronization Input (ESI).

The TCM (ECP+ESI cards) can have a redundant pair as well (total of four cards in the frame). The hardware includes an Intel 25 MHz i960ca processor, 4-8M DRAM, 2M Flash and other circuitry.

The Ethernet port disables the other Ethernet ports on the SCPs.

The DB9 serial allows access by the Environmental Management Interface (EMI, a superset of AMI) to all four SCPs.

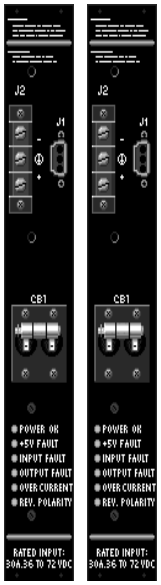
The BITS (Building Integrated Timing Supply) in and out (RJ45) allow a “tree” of switches for timing.

Holdover: netmods=good, fabric=mediocre, switch=bad, but with a CEC+, the holdover is excellent!

ASX-1000, TNX-1100 and MSC-900 Power Supplies

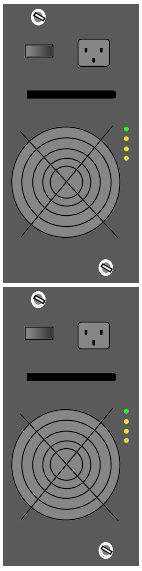
DC

LEDs indicate:
- Input Voltage / Current OK
- +5V supply fault
- Input/Output -VDC out of range (38-70)
- Input current out of limits
- + and - feed wires reversed on input



AC

LEDs indicate:
- Input VAC OK
- Power supply fault
- Out of temp. range
- Overload condition



Core Switch

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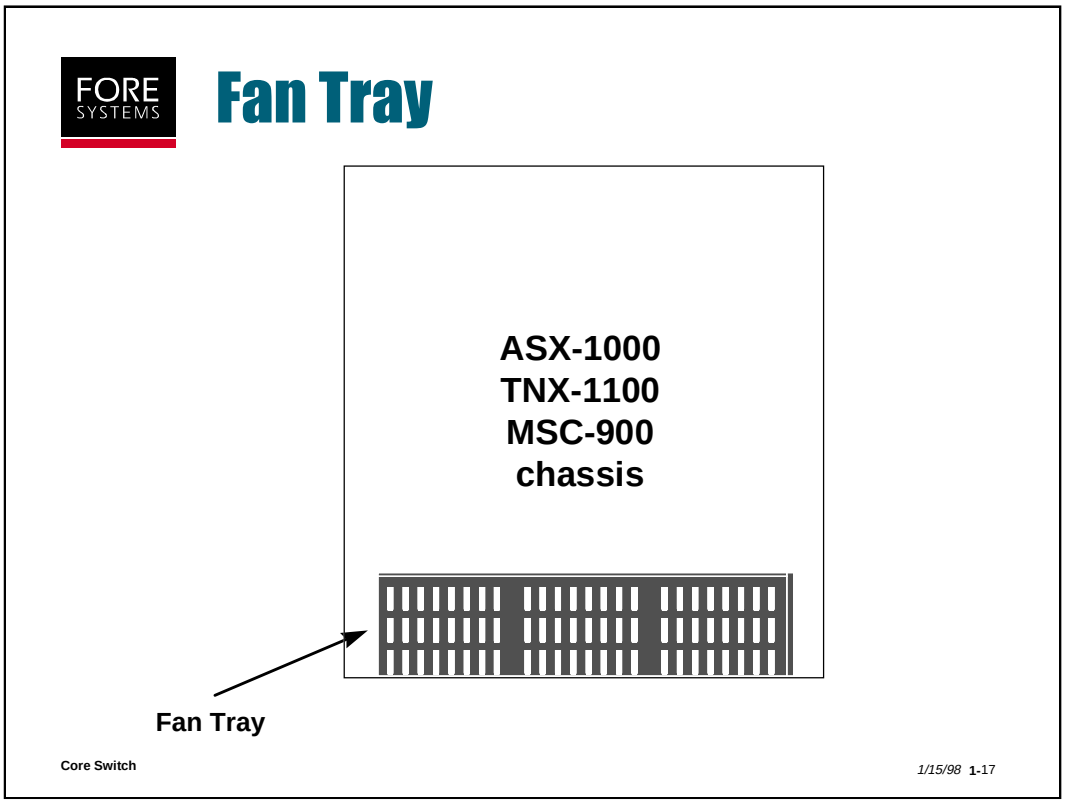
The ASX-1000, TNX-1100 and MSC-900 have redundant, load-sharing, hot-swappable power supplies that can be either 120/240 VAC or -48 VDC. The power supplies are unique because they can supply power from either an AC or DC source to up to four switch boards.

As shown above, the DC supplies are tall and are situated side by side. The AC supplies are twice as wide and are situated on top of each other.



The fan tray for the ASX-1000, TNX-1100 and MSC-900 is removable and replaceable with power applied. Each fan tray contains four fans and the speed of each fan is monitored by circuitry in the CEC+ module so that failure of any or multiple fans can be detected immediately.

Do not run a fully loaded ASX-1000, TNX-1100 or MSC-900 without a fan tray for more than 15-20 minutes, or its power supplies may shut down based on high power supply or fabric enclosure temperatures.

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ATM Switch Hardware Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Network Modules (netmods) are available in interface speeds ranging from 1.5 Mbps to 622 Mbps. True / False

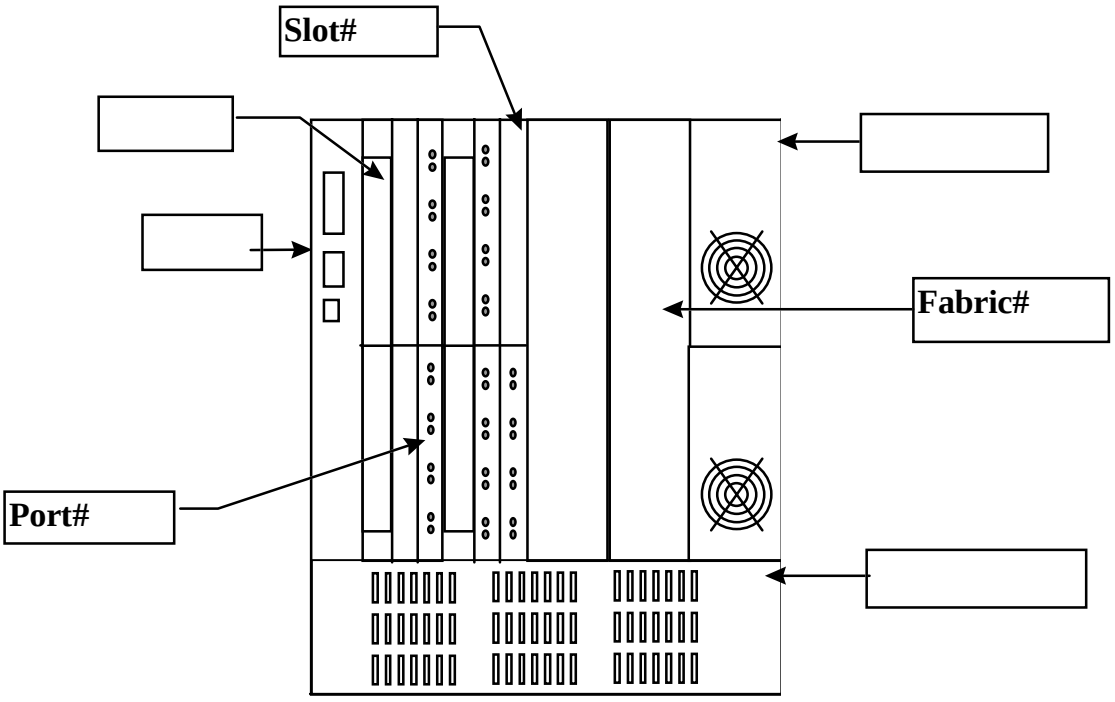
2. The ASX switch models which support DC power supplies are:

   a. All models
   b. ASX-200WG, ASX-200BX, ASX-1000
   c. LE155 and ASX-200WG
   d. None of the above

3. How many netmods can be installed in an ASX-1000? _____

4. On a Common Equipment Card (CEC) in an ASX-1000, what are contact pins labeled AL1 and AL2 used for ?

5. Below is an outline of the components of an ASX-1000. Please label them.



ATM Switch Hardware Practice (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Network Modules (netmods) are available in interface speeds ranging from 1.5 Mbps to 622 Mbps. **True** / False

2. The ASX switch models which support DC power supplies are:

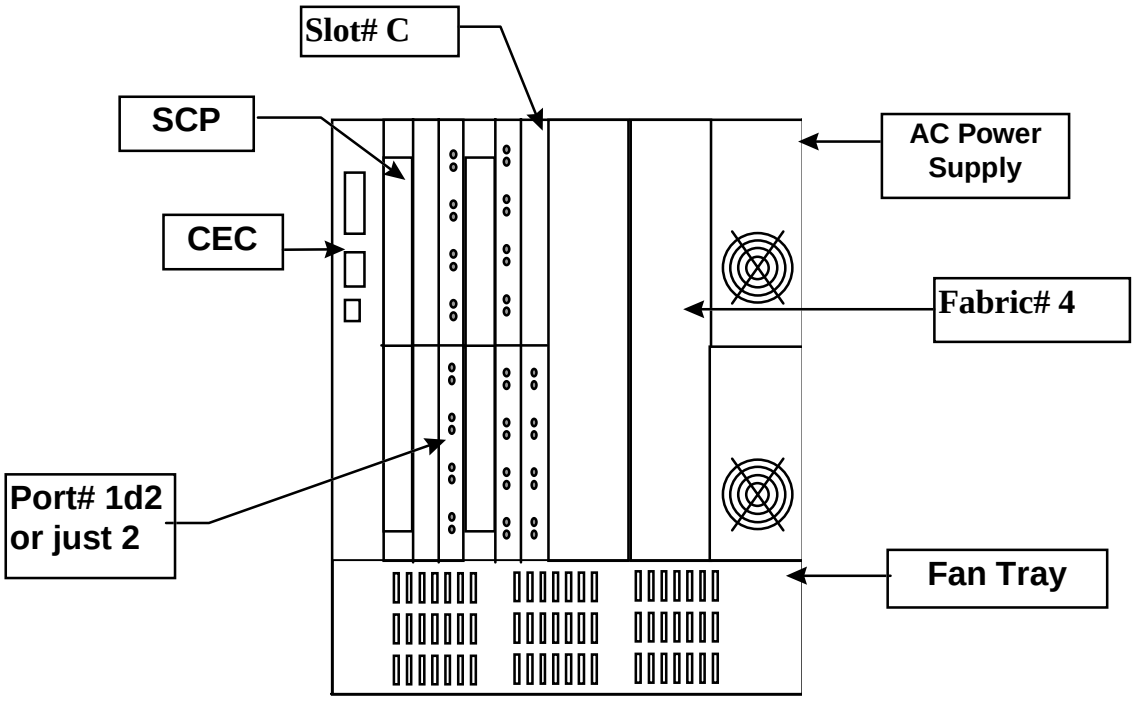
   a. All models
   b. ASX-200WG, ASX-200BX, ASX-1000
   c. LE155 and ASX-200WG
   d. **None of the above**

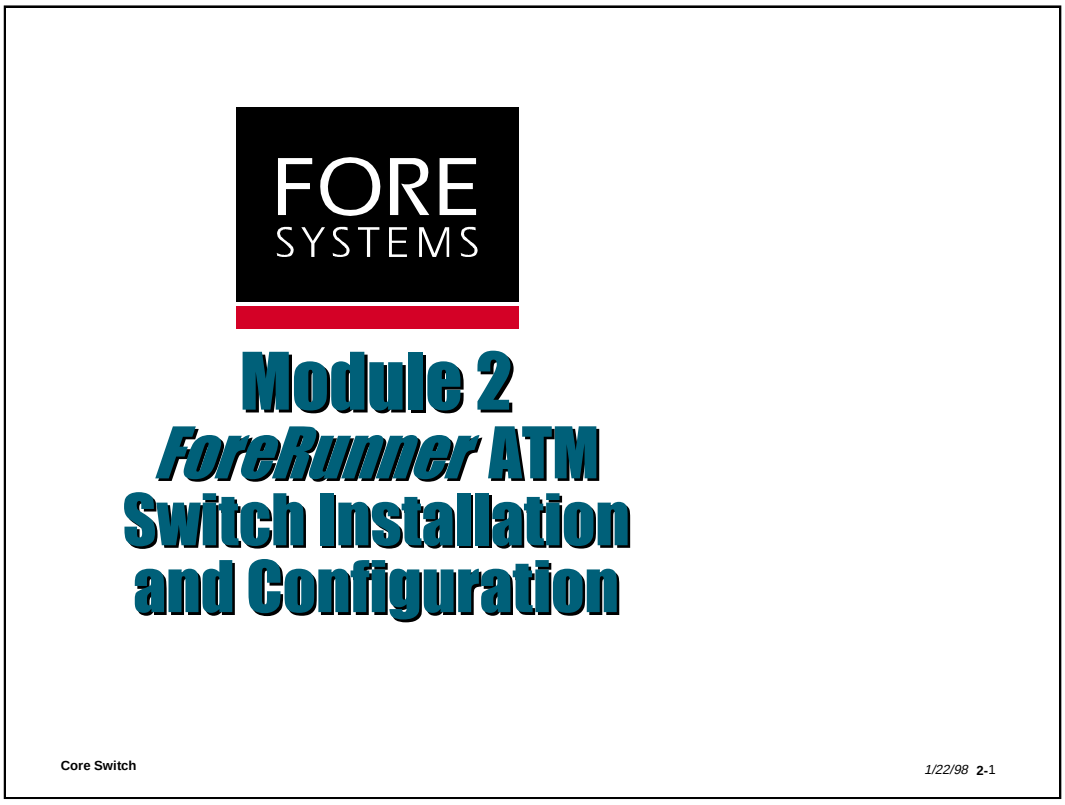
3. How many netmods can be installed in an ASX-1000? ___**16**___

4. On a Common Equipment Card (CEC) in an ASX-1000, what are contact pins labeled AL1 and AL2 used for ?

   Dry contact closure, used to actuate an audible or visible alarm.

5. Below is an outline of the components of an ASX-1000. Please label them.





Rack Mounting Considerations

	200/210	WG/25	LE	900/1000/1100
Rack Mount Kit	X*	Optional	Optional	N/A
Left & Right Bracket	X	Optional	Optional	N/A
Cable Strain Relief Rail	X	Optional	N/A	N/A
Stacking Bracket & Rubber Feet	N/A	N/A	Optional	N/A

- **Remove feet (200/210/WG) and install left and right bracket**
- **Install cable strain relief rail after 200/210/WG is installed in rack**
- **LE 155 may be set on desk top with rubber feet or stacked using stacking bracket and rubber feet**
- **Use two persons to install all ASX/TNX/MSC switches**
- **Insure switches are grounded to rack and rack is connected to earth ground**
- **See Switch Installation and Maintenance Manual**

***"X"=included "N/A"= Not Applicable**

Core Switch

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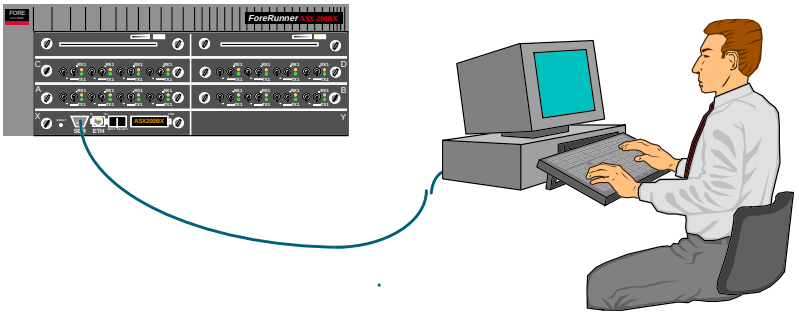
Rack mount kits consisting of left and right brackets plus cable strain relief rails are included with the ASX-200BX or TNX-210 and optional on the ASX-200WG/25 ATM switches The LE 155's optional rack mount kit does not include the strain relief rail but does include a stacking bracket and rubber feet. To install the rack mount kits, turn the unit over on its top and remove the feet from the bottom (200/210 and WG/25 only). The left and right brackets may then be installed. After installing the switch in the rack, the cable strain relief rail may be installed to aid in cable management (200/210 and WG/25 only).

Information such as power requirements, environmental considerations, measurements and weights may be found in the specific ATM Switch Installation and Maintenance Manual.

Management Configuration

- **All switches are supplied with a serial cable to be attached from the serial port on the switch to the serial port of a workstation or a terminal device (VT100).**
- **Default parameters for the serial port are: 9600,N, 8, 1**



Core Switch

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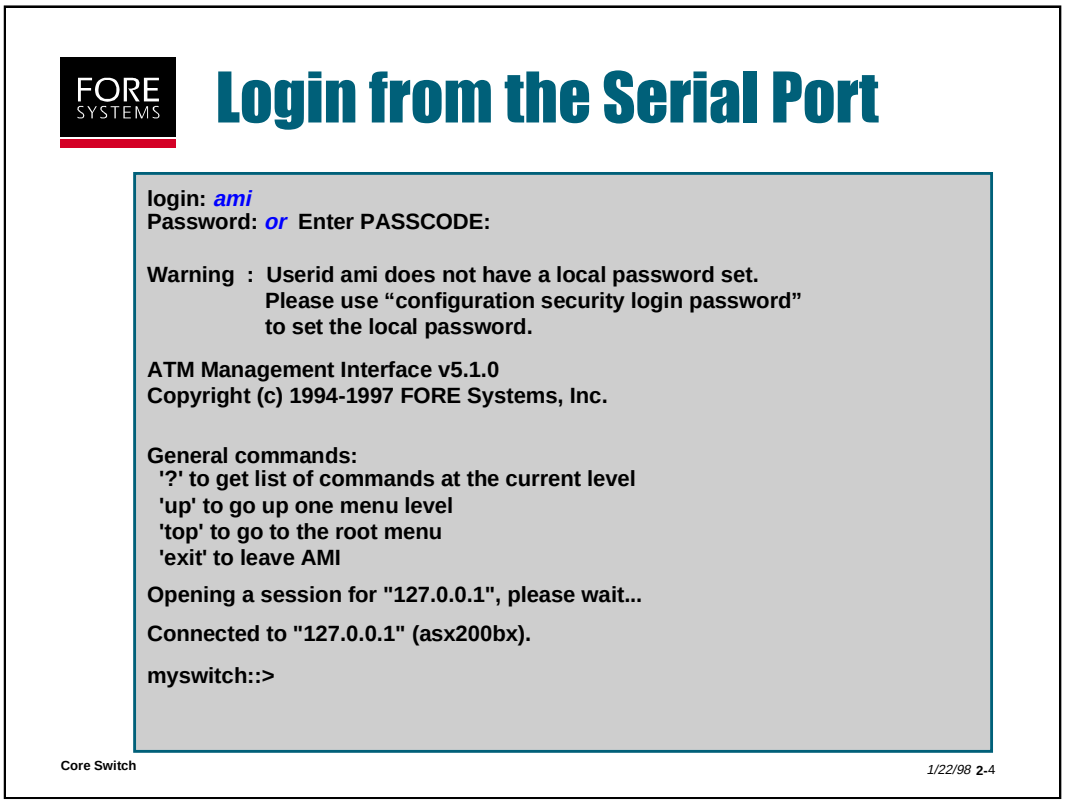
Nearly any standard terminal device can be used to connect to any Fore ATM switch. Commonly a workstation is used by simply connecting the serial port of the workstation to the serial port on the switch using the factory supplied cable (25 pin male d-subminiature to 9 pin male d-subminiature for i960 SCP equipped ASX/TNX/MSC switches) (9 pin female d-subminiature to 9 pin female d-subminiature for the LE 155 and Pentium SCP equipped ASX/TNX/MSC switches). A process (e.g.. HyperTerminal or Tip Hardwire) can then be run on the workstation to communicate with the switch.

The serial port may also be connected to a modem by using a null modem adapter on the factory supplied cable. The following configuration should be used on any Hayes compatible modem:

Setting	Comment
ATE0	Turn off Echoing
ATQ1	No Return Codes
AT&C0	Force Carrier Detect (CD) High
AT&D0	Ignore Data Terminal Ready (DTR)
AT&W	Save Modem Configuration

Sample String: ATE0Q1&C0&D0&W



When you have connected to the serial port correctly, the login prompt will display.

Type in “ami”. If a password has been assigned, you will be prompted to enter the password. If no password was assigned, the messages shown above will be displayed and a session is opened with the SCP.

The “127.0.0.1” IP address shown is for the lo0 (loopback) or localhost interface for the SCP’s IP stack. This interface is “up” by default at power on for serial port-based ami configuration access to the other switch interfaces, e.g. Ethernet (out of band) or ATM virtual interfaces (in band).

By default, a serial port connection times out after five minutes of inactivity. After four minutes of inactivity, you get a message stating that “AMI will timeout in 60 sec if there is no activity”. At ten second intervals following this first message, the message is repeated, counting down the final minute.

Initial Switch Configuration

- **FORE's ATM switches are operational without user configuration**
- **Recommended initial configuration includes:**
  - **IP address for Ethernet/ATM Interfaces**
    - **To access the switch in-band over ATM or out-of-band over Ethernet**
  - **Unique switch name**
  - **Date and Time if necessary**
  - **Passwords for ami and asx admin accounts**

Core Switch

1/22/98 **2-5**

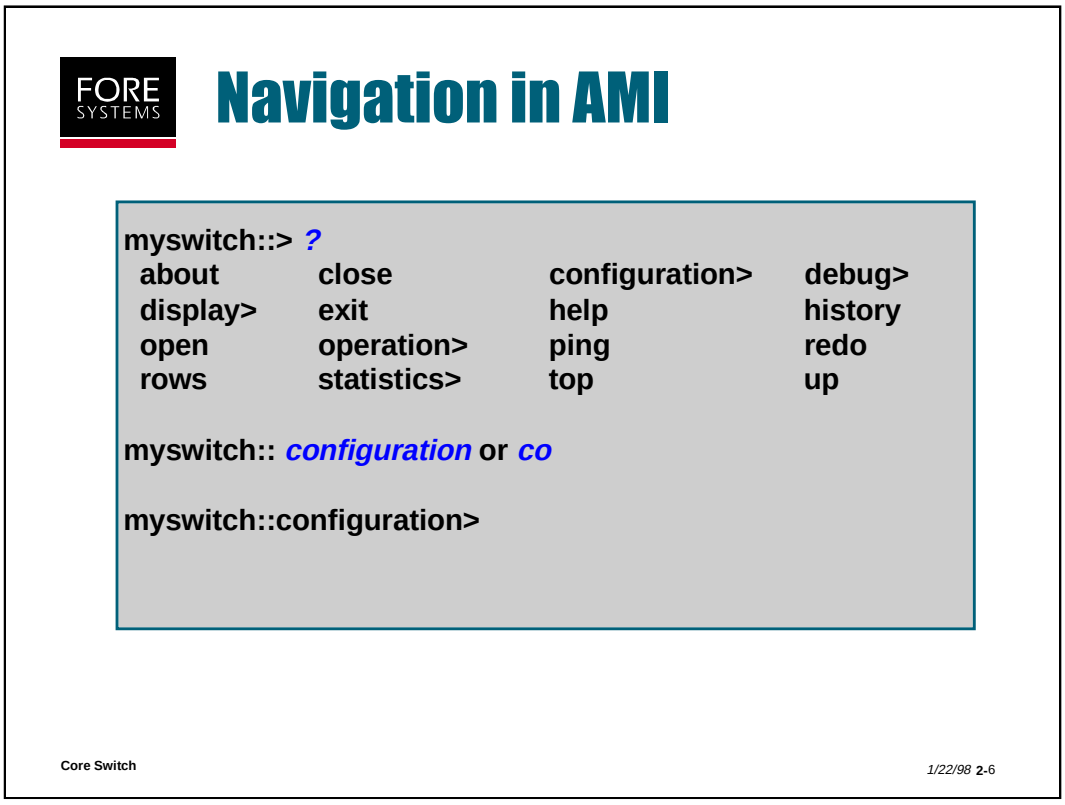
Although FORE's ATM switches are shipped ready to begin switching ATM cells without configuration, you may wish to provide ATM in-band or Ethernet out-of-band management access to the switch by assigning an IP address to one of those interfaces.

You may also want to give the switch a unique name* and adjust the date and time to your specific location (switches are all shipped with the name ATM SWITCH and referenced to a Pittsburgh time zone).

Optionally, you may want to password or passcode protect access to the switch's SCP through the ami and asx userids.

All of these initial configuration options are discussed in greater detail in the following slides.

*Hint: Make the name longer than 8 digits so that it scrolls across the front panel display and you will be able to tell at a glance that the switch's processor is functioning.



Navigation through AMI is quite simple. Typing “?” shows the commands available on that level. Commands can be executed with the minimum number of letters that make them unique on that level (i.e. “co” instead of “configuration” as shown above).

Typing “his” and <RETURN> displays a history of commands that have been previously executed.

To change levels, simply type the name of the desired sub-level. The existence of a sub-level is designated by a “>“ at the end of the name (i.e. Typing “oper” from the initial screen (called root level) would change levels to the operation sub-level). To go up a level, type “up” or “..”. Commands (and level changes) can also be executed with an absolute pathname at any sub-level (i.e. Typing “conf vcc show <RETURN>” has the exact same functionality as typing “conf <RETURN>“ “vcc <RETURN>“ “show <RETURN>“).

Typing “<command name> ? <RETURN>“ will display usage information for that command and typing “help <command name>“ displays general information about that command. It can also be used without any parameters, which will show general information about all commands on that level.

Some commands are executable at any level (i.e. exit, ping, top, and up).

AMI Configuration Commands

```
myswitch::configuration> ?
alarms>          atmarp>          atmroute>        board>
cec>             ces>             ilmiproxy>       ip>
lane>            module>          nsap>            port>
qos>             qosext>          rs232>           security>
snmp>            spans>           spvc>            switch>
system>          timing>          signalling>      upc>
vcc>             vpc>             vpt>

myswitch::configuration>
```

Core Switch

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Each of these configuration commands will open a sub-menu, each sub-menu having commands specific to that part of the switch's overall configuration.

For example, **alarms** - allows you to display, enable, disable or reset various system alarms, while **ces -** allows you to configure circuit emulation service connections and **port** - allows you to manage the configuration of individual ports.

For a complete list of details concerning all of the AMI configuration commands refer to the AMI Configuration Commands Reference Manual.

ATM Switch " IP " Interfaces

- **The switch has a number of internal IP-based interfaces (mainly used for ATM in-band and Ethernet out-of band management access)**
- **The ATM interface supports a number of "virtual interfaces" that are used with IP data over ATM applications.**
- **Switch Interfaces:**
  - **ie0** **Ethernet Interface**
  - **asx0** **ATM interface for FOREIP**
  - **qaa0-3** **ATM interfaces for Classical IP (up to 4)**
  - **elx** **ATM interfaces for LANE (up to 16)**
  - **lo0** **Switch localhost interface**
- **Each interface must be on a different IP subnet**

Core Switch

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The switch identifies each of its internal IP-based network interfaces with the following notations: ie0, asx0, qaa0-3, elx and lo0.

Some of these interfaces are very similar to the interfaces that are found in a workstation. They are associated with the SCP's out-of-band ethernet port and in-band atm virtual interfaces which are used to support FOREIP, Classical IP and LANE data over ATM applications. The localhost interface actually allows AMI to run on the switch in a default condition from the serial port, prior to any of the other interfaces being configured.

Hosts with Ethernet adapters see their Ethernet interface as "le0" but the switch calls its Ethernet interface "ie0".

Hosts with *ForeRunner* ATM adapters see their FOREIP ATM interface as "fa0" but the switch calls its FOREIP ATM interface "asx0".

Both hosts with *ForeRunner* ATM adapters and switches use the terms qaa0-3 and elx to describe their Classical IP and LANE interfaces respectively.

Since each type of interface represents a different form of IP communication (i.e. different encapsulation), each needs to be associated with a different IP subnet address.

IP Address Configuration

```
myswitch::configuration> ip

myswitch::configuration ip> ?
  address       admin         broadcast     forwarding
  mask          mtu           route>        show
  unconfigure

myswitch::configuration ip> sh

interface   state   address     netmask     broadcast   mtu
lo0         up      127.0.0.1   255.0.0.0   N/A         4096
ie0         down
asx0        down
qaa0        down
qaa1        down
qaa2        down
qaa3        down

IP Forwarding State: not forwarding
```

Core Switch

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By changing to the ip sub-menu, you may set the address for the internal switch interface(s), set the broadcast and subnet masks, turn IP forwarding on or off, add or delete static routes, bring the switch interface(s) administratively up or down, and show the current state of the interface(s).

By issuing the *show* command, AMI will read the current status of the switch interfaces and return this information to the screen.

Notice that with a new switch, the asx0 and qaa<n> interfaces, as well as the Ethernet interface are unconfigured and that the LANE el<n> interfaces do not even show up until specific LANE commands are issued. In order to allow IP access to the switch (which in turn will enable SNMP access), you must configure an IP address for at least one of the interfaces. The lo0 interface is up and assigned a default address automatically, so you can always determine the state of your IP stack by pinging that address.

By setting an IP address for the asx0, one of the qaa<n> or one of the el0 interfaces you allow in-band (over ATM) access to the switch control processor.

By configuring an IP address on the Ethernet interface (ie0) you enable out-of-band access to the switch control processor.

IP Address Configuration (cont'd)

```
myswitch::configuration ip> address ie0 169.144.229.45

myswitch::configuration ip> add qaa0 169.144.230.45

myswitch::configuration ip> sh

interface   state   address          netmask         broadcast          mtu
lo0         up      127.0.0.1        255.0.0.0       N/A                4096
ie0         down    169.144.229.45   255.255.255.0   169.144.229.255    1500
asx0        down
qaa0        down    169.144.230.45   255.255.255.0   N/A                9180
qaa1        down
qaa2        down
qaa3        down

IP Forwarding State: not forwarding
```

Core Switch

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Notice that setting the address for a given interface does not change it's administrative state. You must specifically enter the admin command (next slide) for each interface whose state you wish to change. You can selectively set the state to up or down.

Notice also that you do not have to type in netmask and broadcast mask values unless you want to use something different from the assigned default values.

IP Address Configuration (cont'd)

```
myswitch::configuration ip> admin ie0 up

myswitch::configuration ip> adm qaa0 up

myswitch::configuration ip> sh

interface   state   address          netmask        broadcast          mtu
lo0         up      127.0.0.1        255.0.0.0      N/A                4096
ie0         up      169.144.229.45   255.255.255.0  169.144.229.255    1500
asx0        down
qaa0        up      169.144.230.45   255.255.255.0  N/A                9180
qaa1        down
qaa2        down
qaa3        down

IP Forwarding State: not forwarding

myswitch::configuration ip> ..
```

Core Switch

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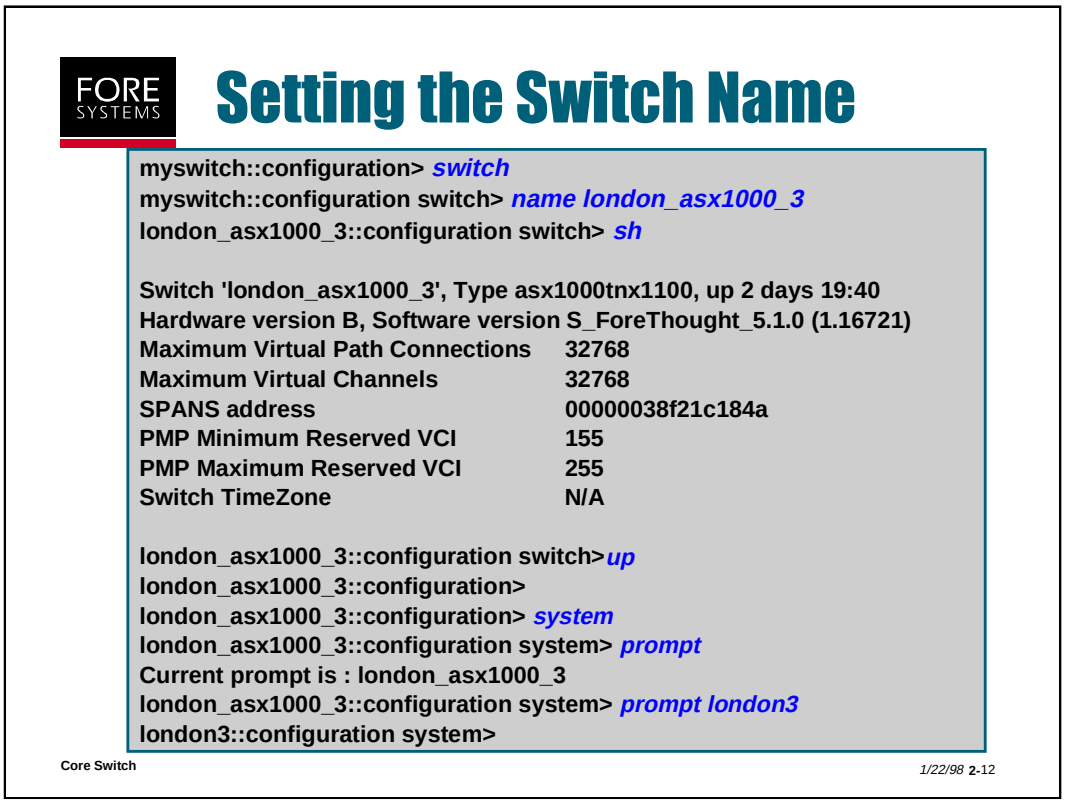
Notice on this slide that after each individually addressed interface has been "admin'd up" its state now has changed from down to up. At this point, the switch can transmit to or receive from any other valid interface on the subnet designated by the address field of each "up" interface.



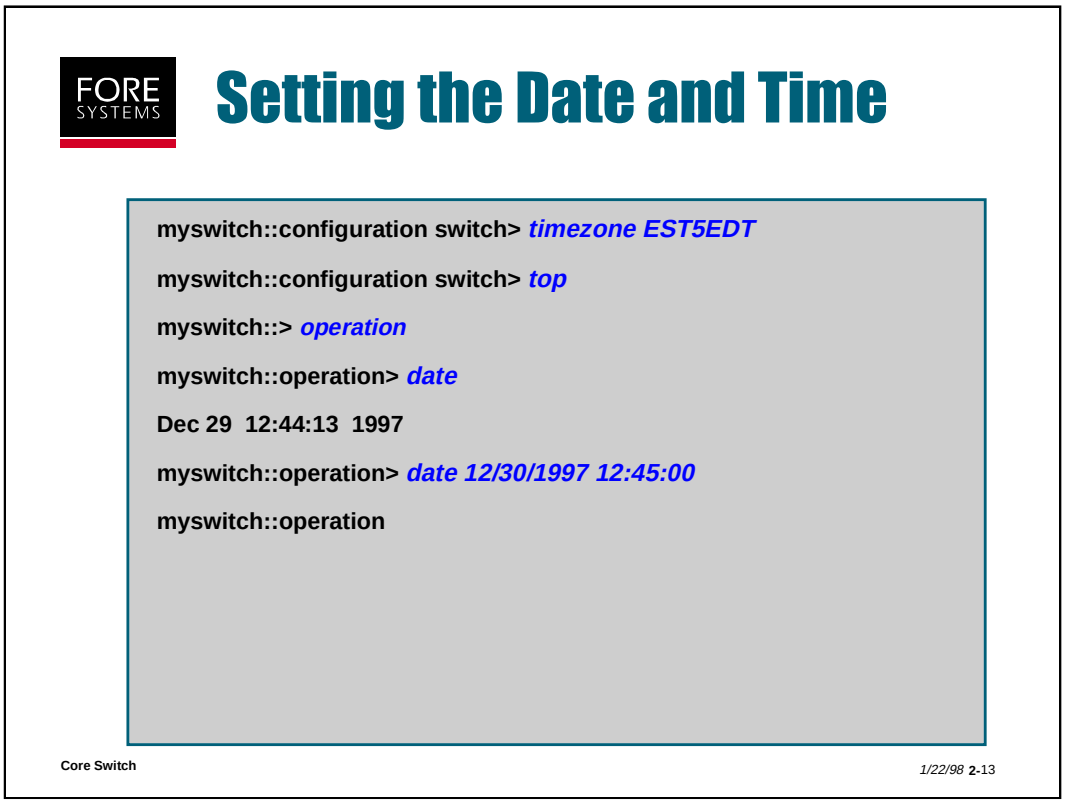
Setting a name on the switch can be useful when a network contains a large number of switches. The default name for the switch is ATM SWITCH, and if a unique name is not given, it may be difficult for the user to verify that he is logged into the desired switch.

As shown above, when a unique name is given using the “configuration switch name” command, the name of the switch will be shown as the new switch prompt (unless a different prompt name was already assigned using the “configuration system prompt” command).

By naming switches logically, such as by geographic location or department name, it can be much easier for the user to identify the switch they are connected to. Additionally, *ForeView* Network Management Software will label switches in the network map with their name if one is given.

The “configuration system prompt” command shown is used to change the prompt displayed at the beginning of each AMI command line. In the case above, the prompt name “london3” was used instead of the longer switch name “london_asx1000_3”.

To match the prompt to the actual switch name simply type “***configuration system prompt -default***”.



The proper timezone of your location should be set using the "configuration switch timezone" command.

Available "automatic" timezones are:

EST5EDT = Eastern Standard Time

CST6CDT = Central Standard Time

MST7MDT = Mountain Standard Time

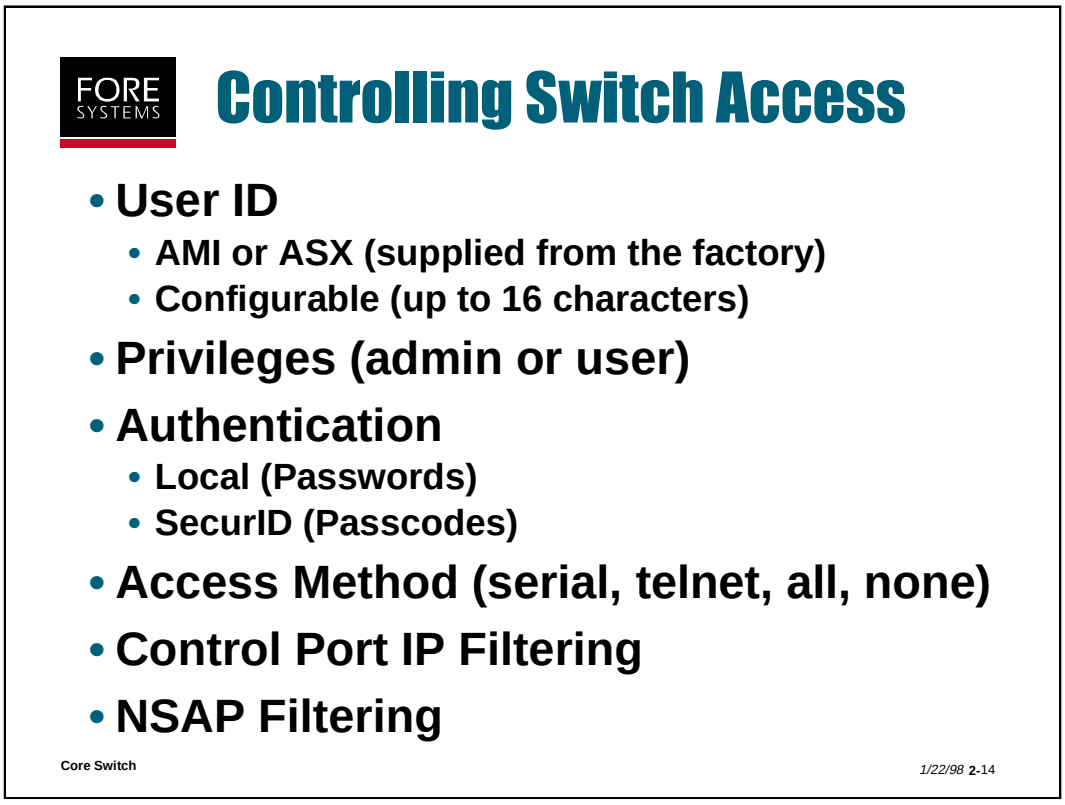
PST8PDT = Pacific Standard Time

AKST9AKDT = Alaska Standard Time

Setting the timezone with this command also allows your switch to automatically adjust for Eastern Standard or Daylight Savings Time. For locations outside these timezones, consult the AMI Configuration Command Reference Manual for the exact POSIX standard 1003.1-1988 formula

After setting the timezone, you may need to adjust the date or time from Pittsburgh's to your location's.

Use the "operation date" command to adjust the actual date and time within the timezone as shown above.



There are two User IDs supplied by FORE Systems from the factory, "**ami**" and "**asx**". Unique User IDs of up to 16 characters in length may also be created. Each of these User IDs may be used to login to a switch, and each may be individually assigned a privilege level, an authentication method, filtered by way of SCP ip access, filtered by way of VC NSAP address and individually assigned a unique access method.

There are two levels of privileges which may be assigned to a User ID (**admin** or **user**).

Authentication may be designated for a User ID as **local** (requiring a **password**) or **SecurID** (requiring a **passcode**).

IP filtering may be configured for the switch's control port, such that only those IP addresses associated with a table of 32 authorized entries may gain access to the IP interfaces of the switch.

NSAP filtering may be configured for calls based on a combination of calling and called NSAP addresses, as well as source and destination ports, VPIs and NSAP address masks.

There are four access methods which may be associated with a User ID (**serial**, **network** (telnet), **all** (both serial and network) and **none**).

All of these options are presented in more detail in the following slides.

Displaying UserID Information

```
myswitch::configuration>security

myswitch::configuration security>?
   ipaccess>       login>              nsapfiltering>

myswitch::configuration>login

myswitch::configuration security login> show

                    Authentication                          Login
Userid              Method              Privileges          Access
-------------------------------------------------------------------------------
123456789           local               user                all
ami                 local               admin               all
is&s                local               admin               all
marketing           securid             user                network

myswitch::configuration security login>
```

Core Switch

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To display your current UserID configuration simply type “configuration security login show” (Note that this command is only available to users with admin privileges).

The display shows a list of Userids, their associated authentication methods, their privilege level and their access method.

Creating a new UserID and/or new password

conf security login new <userid>
[-auth (local | securid)]
[-priv (admin | user)]
[-access (all | network | serial | none)]

```
myswitch::configuration security login> new sales -auth local -priv user -access network

    New local password:   <new local password>
    Retype new local password:   <new local password>

    New userid sales created with local authentication, user privileges, and network
    login access.

myswitch::configuration security login> password [<userid>]
  Old local password: <old local password>
  New local password: <new local password>
  Retype new local password: <new local password>
```

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A first step in switch security can be implemented by configuring userids for anyone who will have access to each switch. The userid can be up to 16 characters long and any characters are acceptable except colons and blanks.

Authentication may be configured in one of two ways:

Local authentication requires a userid and a password, which is stored locally in the switch. Password validation is done when opening an AMI session using the serial port or by telnet (but not when using a remote switch or *ForeView*). Local is the default authentication method.

SecurID authentication requires a userid and a SecurID passcode, which is comprised of a PIN and an assigned SecurID token.

You are prompted to assign a password regardless of which authentication method is selected and null local passwords are accepted. Passwords may be changed as shown above.

Privileges may be assigned as admin or user for each new userid created. “Admin” allows access to all AMI commands and is the default privilege. “User” does not allow access to any “configuration security” commands (except the one used to modify your own password), all “debug” commands and the “configuration snmp sets” command.

Access may be designated in one of four different ways.

Configuring SecurID

```
myswitch::configuration security login> securid ?
     getconf                delete                showconf

myswitch::configuration security login securid> showconf
  SecurID Client Configuration

  ACE/Server VERSION:  v  2.1.104
  CLIENT RETRY:  5 times
  CLIENT TIMEOUT:  5 sec
  BAD PASSCODES:  3
  DES ENCRYPTION:  allowed and enabled
  DURESS MODE:  not allowed
  MASTER SERVER:  linus
  MASTER SERVER ADDRESS:  204.95.89.107
  PORT NUMBER:  1024
  AUTHENTICATION SERVICE:  securid

or
  Securid configuration file does not exist or is corrupted.
```

Core Switch

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If securid is selected for the userid authentication method ("configuration security login new <userid> -auth *securid*"), this means that this user will be validated by the SecurID server when he attempts to login to the switch.

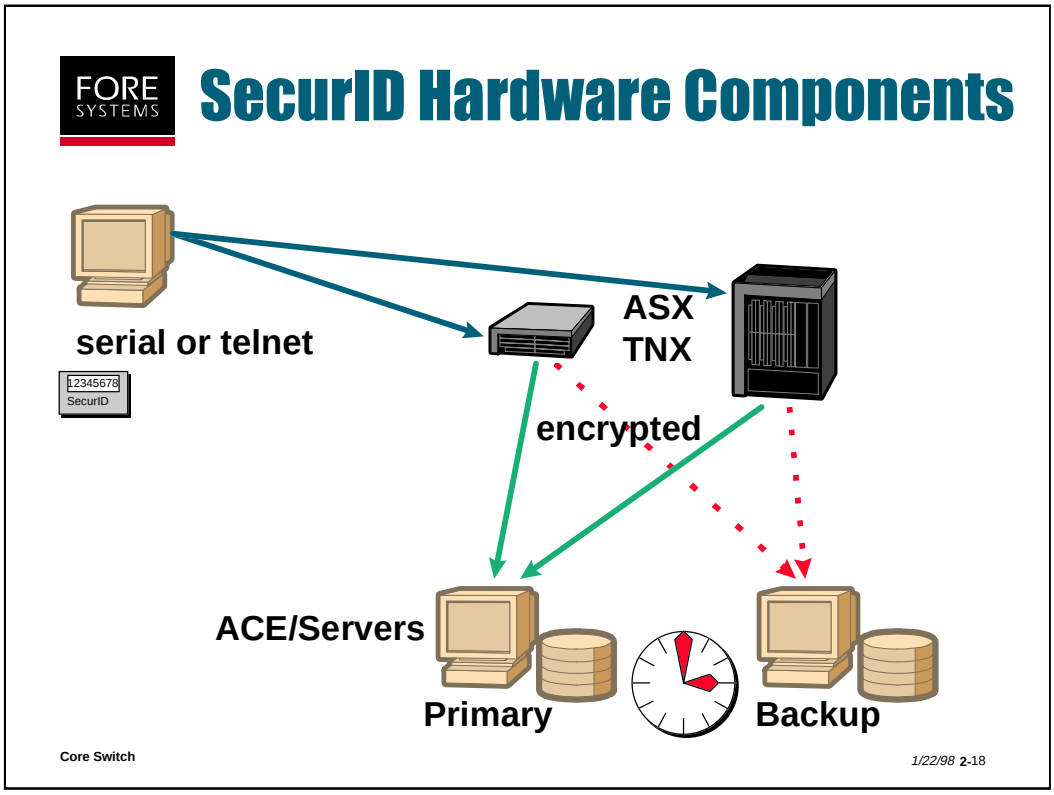
The SecurID file (shown above) is located on and only editable from the SecurID server.

You use the "getconf" command to retrieve the file from the SecurID server and put it into FLASH memory on your switch.

You use the delete command to delete the file from FLASH memory.

All of these commands require admin level privileges.

The following two slides give more detail in regards to the SecurID process and components.



Security Dynamics® (http://www.securid.com) sells add-on hardware/software to enhance the security of the switches. The servers are UNIX workstations with approximately 240 MB free disk and some physically secure links (ATM or Ethernet) to the switches (i.e. in the same locked room).

A switch could be configured for a SecurID® ACE/Server® or not. If it is, then password prompts are sent encrypted to the active server for confirmation. Multiple switches can share the same server. If that server were to fail, a backup server can take over. If all servers are dead, the switch could use its optional local password files. The servers are administered with a GUI interface (that code is purchased separately from Security Dynamics).

When someone attempts to log in to a switch, the user will enter a PIN number plus a constantly changing number from the SecurID **token** (see next page). The number changes once per minute.

_____

Security Dynamics, SecurID, ACE/Server are all registered trademarks of Security Dynamics Technologies, Inc.

SecurID Tokens

PIN +

Core Switch

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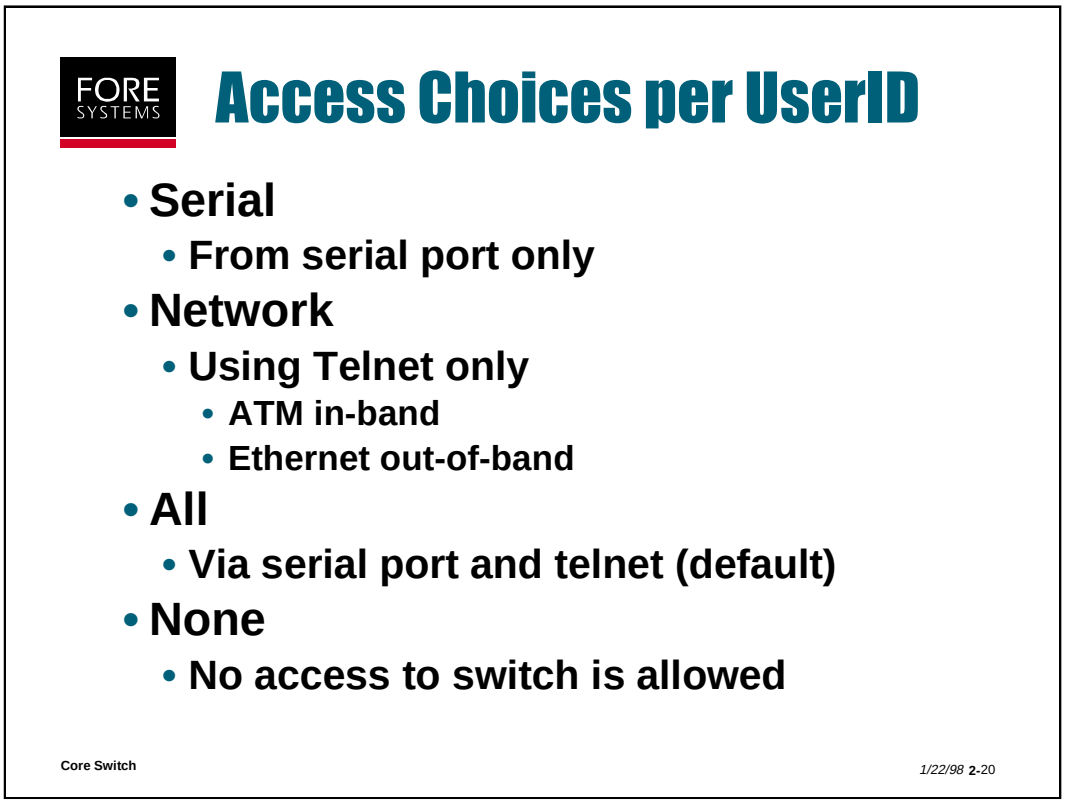
The SecurID tokens (either a credit-card sized device or a key-fob) are completely external and do not attach to the switch in any way. All they do is display a changing number that is synchronized with the servers. Every 60 seconds the numbers change. There is a mechanism for synching a small time slip between the server and the card. For instance if you enter the number that was valid last minute, the server assumes that your card is slipping by a few seconds and compensates for that. There is an option to enter a PIN directly onto the card itself (picture on top right).

If the card is stolen, it does little good since it also needs a PIN (which hopefully you did *not* write on the back of the card). This is referred to as two-factor security. If you forget your card, the administrator can issue you a one-time password.

Notice the key on the chain? That is not part of SecurID, but is a good reminder that if the switch is not in a locked room, then anyone could go up and pull the plugs. "*Denial of service" is just as costly as "*theft of service," perhaps more so.

---

* Computer crimes could be classified into the following 5 categories (and examples): denial of service (shutting down their machine), theft of service (using it without paying), theft of information (stealing credit card numbers), damage of information (changing my grade from a D- to an A+), recreational pranks (post a file "I Was Here!" inside a CIA machine.)



The slide above shows the various terminal access methods available to be assigned to any configured UserID. Notice that the default is "all" which means that the ami, asx, and any specific userID which is configured has initial access from both the serial port and via telnet (in-band or out-of-band).

Switches may also be accessed via SNMP using *Foreview* or a remote AMI session.

A remote AMI session is initiated from an existing terminal session by issuing the "open" command as shown below:

myswitch::>*open 208.121.29.2 private*

Opening a session for "208.121.29.2", please wait…

Connected to "208.121.29.2" (asx200bx).

***otherswitch::>**

The asterisk in front of "otherswitch" above indicates that this prompt is for another switch other than the one on which it is being displayed. Password usage is not required. To return to your local session type in ***localhost*** and press <RETURN>.

Many commands are not available through a remote session including most of the "operation flash", all of the "operation panic, reboot, and version", some of the "configuration system" and the "operation cdb init" commands. See the AMI Manual for a complete list.

Starting a Telnet Session

```
>telnet <ip address of SCP>

Trying 204.95.89.231…
Connected to myswitch.
Escape character is '^]'.

or
Userid <<userid>> is already logged into AMI.
Exiting...

S_ForeThought_5.1.0  (1.16721)  (asx200bx)  (myswitch)

login:ami
Password: or Enter PASSCODE

ATM Management Interface v5.1.0….
General commands:….
Opening a session for "127.0.0.1", please wait...
Connected to "127.0.0.1" (asx200bx).

myswitch::>
```


This slide shows how to access the SCP through telnet (either in-band with ATM or out-of-band with Ethernet). As you can see, the SCP has to have at least one of its interfaces configured with an IP address.

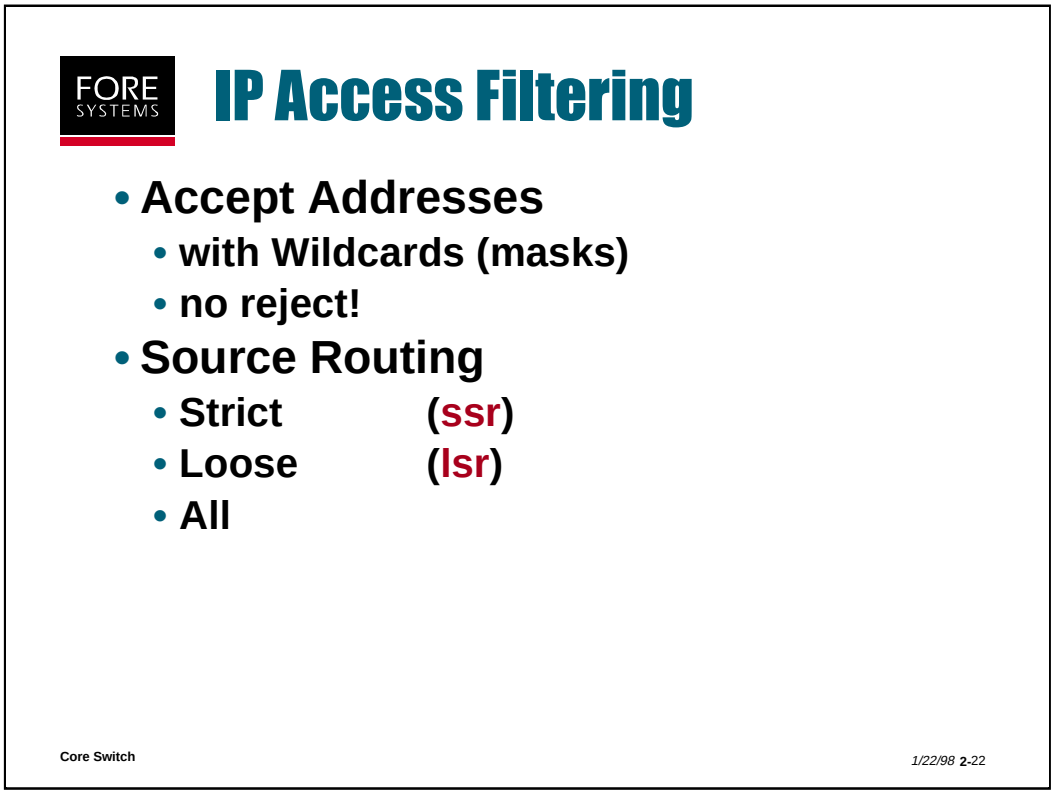
If another userid is running a telnet or serial port session on that SCP, you will see the message shown above. Remember, only one telnet or serial port session at a time on any one SCP.

Once you see the login prompt, just type in “ami” and the assigned password (if one is required) or PASSCODE.

Telnet sessions, like serial port direct connections, time out by default after five minutes of inactivity. After four minutes of inactivity you get a message stating that “AMI will timeout in 60 sec if there is no activity”. At ten second intervals following this first message, the message is repeated, counting down the final minute.

Remember also that a serial port direct connection has the highest priority and access level, so if someone decides to run a serial port session while you are running a telnet session that person gets a prompt asking if he would like to disable your telnet session. If he types “y” for disabling your session you will see the following prompt:

The ami client running on the serial line has suspended your session. Try again later
Connection closed by foreign host.



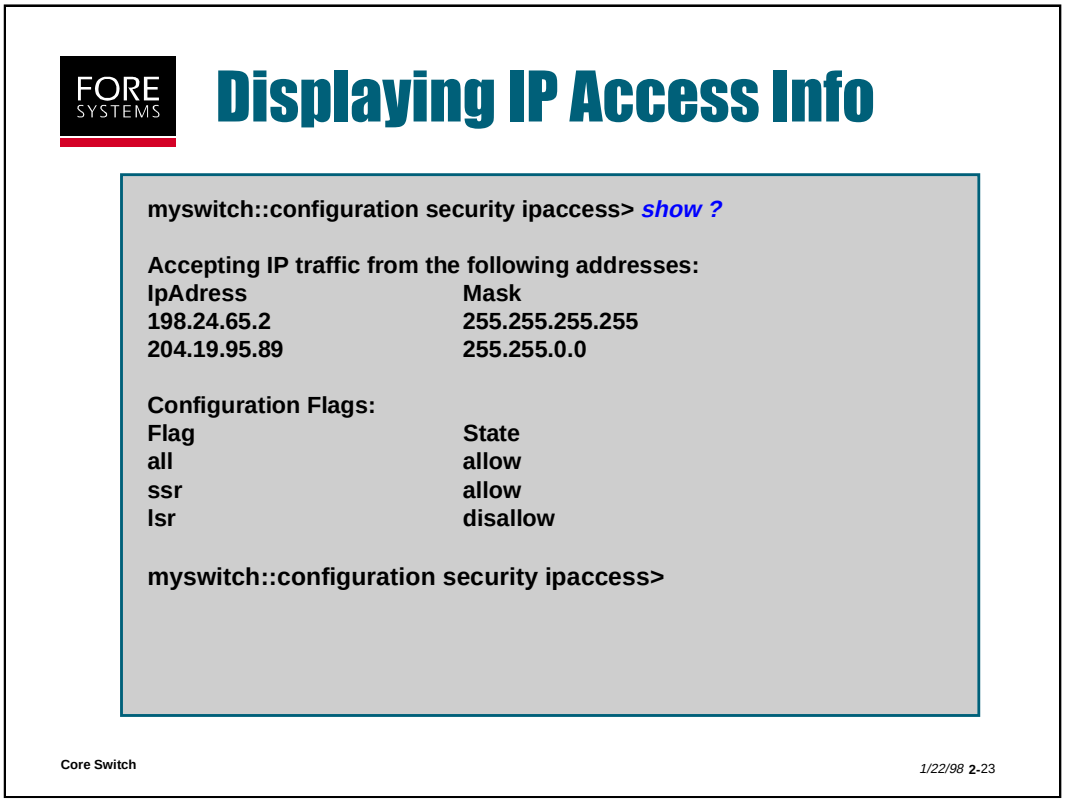
This is Layer 3 IP Filtering, for filtering calls to the SCP, not inter-port traffic. IP addresses which are authorized to access the SCP are entered into an IP Filter table which contains a maximum of 32 entries. No entries (the default) means accept anyone.

myswitch::configuration security ipaccess> *?*
accept delete ssr lsr all show

The “accept” command is used to make a table entry (ip address and mask). The “delete” command is used to remove an entry from the table. There are no commands to explicitly reject certain IP addresses. The “ssr” Strict Source Routing (how did I get here, no learned routes) tag helps to prevent spoofing of addresses. To only accept ssr packets from anything on the 12.34.0.0 subnet, type the following commands:

configuration security ipaccess> *accept 12.34.0.0 255.255.0.0*
configuration security ipaccess> *lsr disallow*
configuration security ipaccess> *ssr allow*

The “lsr” command can be used to specify that the switch allows or disallows loose source routed packets from the list of IP addresses in the table. The “all” command is used to allow or disallow all forms of source routed packets from the list of IP addresses in the table.



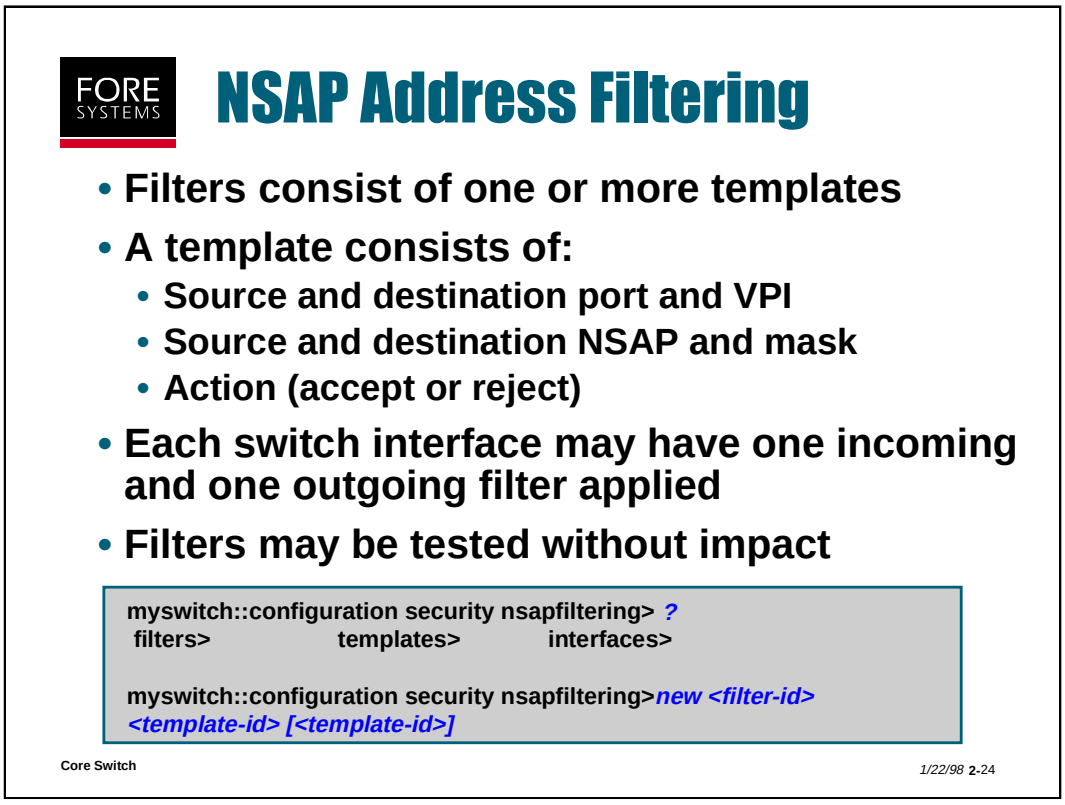
To see all the entries which have been made into the ipaccess table simply type “configuration security ipaccess show”.

Notice that the entries are listed by IP address and mask. There are a maximum of 32 entries allowed. The mask indicates the significant part of the IP address to be used when filtering IP access of the SCP.

The top entry shown above of 198.24.65.2 with a mask of 255.255.255.255 indicates that only address 198.24.65.2 is accepted against that entry, while the second entry of 204.19.95.89 with a mask of 255.255.0.0 indicates that addresses 204.19.*.* are accepted against that entry. A mask of 0.0.0.0 is a wildcard which allows all addresses.

All entries are also filtered against the flags that are configured and shown above. In the slide above, all loose source routed packets are disallowed even if their address matches one in the table.

The default for ipaccess is no entries (all IP addresses have access) and all flags set to allow (no source route packet restrictions). If you do choose to enter an ip address, make sure the first one includes an address or mask that supports the terminal you are using to configure the switch, or you may lock yourself out.



NSAP Address Filtering allows you to filter calls (VCs) based on a combination of calling and called addresses, source and destination ports and VPIs (paths).

An NSAP Address Filter is created by linking it to one or more templates as shown above.

The filter and template ids may be either a positive decimal integer or name string up to 20 characters long.

To see which filters have been configured on the switch type the following:

```
myswitch::configuration security nsapfiltering filters>show
Index   Name   Template  Ids
  1                      1    2    48
  2                      3    256
  5      okay            let_these_in    15
```

Notice that each filter index number or optional name has several templates with which it is associated. The templates are applied left to right as shown in the display.

Creating a filter template

```
myswitch::configuration security nsapfiltering templates>new <template-id>
[-srcport <port>] [-srcvpi <vpi>] [-srcnsap <nsap>] [-srcmask <mask>]
[-dstport <port>] [-dstvpi <vpi>] [-dstnsap <nsap>] [-dstmask <mask>]
-action (accept | reject)

 myswitch::configuration security nsapfiltering templates>show
                                          Source              Destination
Index  Action  Name                 Port   VPI  Mask   Port   VPI   Mask
  1    accept  let_these_in          1A1    5    128     *      *     152
Source NSAP:       0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.f0
Destination NSAP:  0x47.0005.80.ffe100.0000.f21a.2a1d.0020481a2a17.00

  3    reject  keep_these_out       1A1    *    104    1CTL   *      0
Source NSAP:       0x47.0005.80.ffe100.0000.f21a.11f2.002048100464.00
Destination NSAP:  *

or
myswitch::configuration security nsapfiltering templates>show
No Address Filtering Templates are present
```


Templates are created as shown above using the “configuration security nsapfiltering templates new” command. Enter all of the appropriate parameters and select an action (accept or reject). The action identifies the action to take with NSAP addresses that match the parameters in the template.

An asterisk is used as a wild card which indicates “any” (port, VPI or NSAP address). A zero mask indicates “match all addresses”.

Displaying filtered interfaces

```
myswitch::configuration security nsapfiltering interfaces>show [<port>
[<vpi>] ] [-filters] [-templates]

 myswitch::configuration security nsapfiltering interfaces>show -filters
Port   VPI  Direction  Filter  Name                Template  Ids
------ ---- ---------- ------- --------            ----------
1A1     0    Incoming     21                       10  12  40
1A2     0    Incoming    459   keep_them_out       45  46  47  48
1A2     0    Outgoing     94                       49  50
1A4     0    Outgoing     36   filter_36           3984
1CTL    0    Outgoing     37   ctlport             625

myswitch::configuration security nsapfiltering filters>lookup <filter-id>
[-srcport <port>] [-srcvpi <vpi>] [-srcnsap <nsap>] [-dstport <port>]
[-dstvpi <vpi>] [-dstnsap <nsap>]
```

Core Switch

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As mentioned previously, filters may be applied to incoming and out going interfaces (one each). In the example shown above, two different filters are applied to the port 1A2 path 0 interface (#459 for incoming and #94 for outgoing).

If you want to test a particular call setup message to see if the call would be established against a particular filter, use the “configuration security nsapfiltering lookup” command as shown above. The switch will return an answer of “accepted” or “rejected” and the template-id of the specific template that accepted or rejected the tested call setup message. If the message does not match any of the templates in the filter, the switch returns an answer of “rejected” and “address unknown”.

This is a test only, and as such does not set a trap or show up as a failed connection attempt.

Starting a *ForeView* Session

- On a Sun workstation simply run “fvmap” from /usr/local/foreview/bin
  - Insure your switch shows in the dialog box
  - *Note Sun will use SNMP over FOREIP interface configured at power-up
- On a WindowsNT PC select the *ForeView* program group and double click on the FVMAP icon
  - *Note PC would need interface configured for SNMP over ATM/Ethernet on same network as switch (not initially configured)

Core Switch

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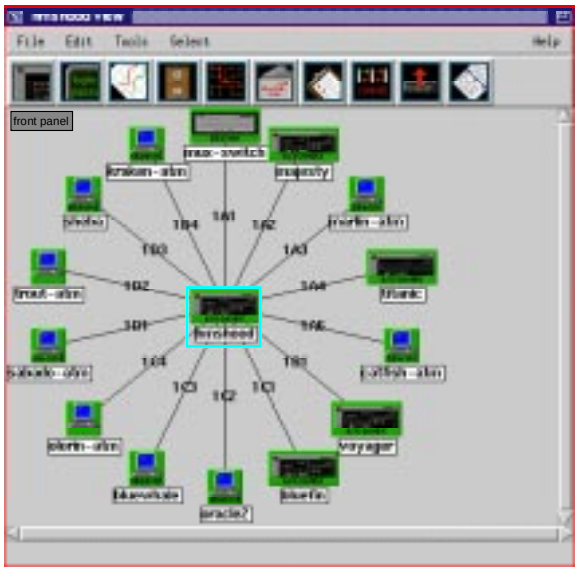
Either of the steps above will lead you to the same *ForeView* network map screen (shown on the next slide) from which you can go into Front Panel view, VCC creation mode, etc.

You can even run the previously discussed AMI or Telnet sessions from this initial screen.

Initial *ForeView* Screen

- **Discovers all ATM attached devices on the network and shows them in relationship to your defined "first discovered component"**



Core Switch

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If you select a switch by clicking on it once with the mouse the switch icon will be surrounded by a blue box indicating that it is selected (as shown above).

The first icon on the left of the above screen may then be used to move to a front panel view of that selected component (click on icon and release on front panel pull-down).

The front panel view (shown on the next page) may then be used to monitor items related to switch/module/port characteristics.

ForeView Front Panel Screen

- **From this view you get an accurate representation of switch configuration and alarms, port type and status, etc.**

Core Switch

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The Front Panel view allows you access to many switch specific pieces of information.

Clicking on the FORE logo displays switch information (like running “conf sw sh” under AMI).

Clicking on a port shows port statistics.

Clicking on the display LED shows SCP statistics.

The port LEDs represent current link status and even show the name of the device to which that port is attached.

The panel at the top of the switch shows power supply and temperature status.

In the following slides you will see which of these are very useful to complete a thorough switch installation.

Displaying Switch Information - AMI

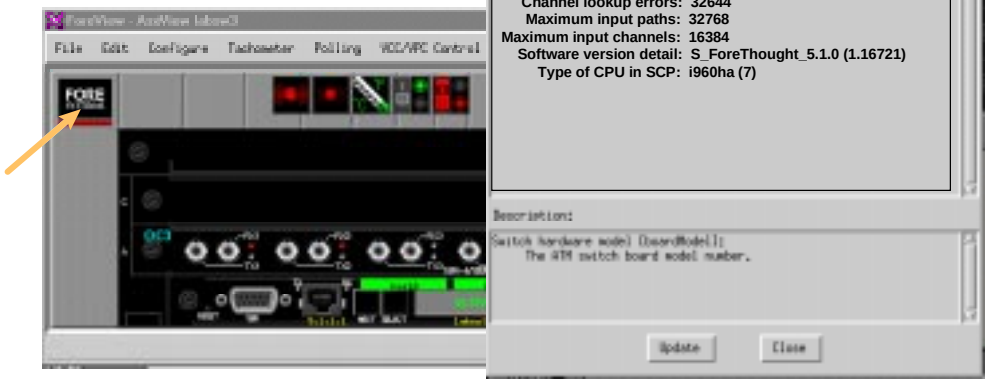
```
london::configuration> switch

london::configuration switch> sh

Switch 'london', Type asx200bxtnx210, up 2 days 19:40
Hardware version B, Software version S_ForeThought_5.1.0 (1.16721)
Maximum Virtual Path Connections    32768
Maximum Virtual Channels            16384
SPANS address                       00000038f21a0e87
PMP Minimum Reserved VCI            155
PMP Maximum Reserved VCI            255
Switch TimeZone                     N/A

london::configuration switch>
```


Notice that when using AMI to display switch information you are told the name of the switch, how long it has been running and the versions of hardware and software.

Also shown is the switch's SPANS address, and what time zone it has been assigned (if different from factory default).

Displaying Switch Information - *ForeView*

- **Right click on the FORE Systems logo to get Switch Info**



Core Switch

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To display switch information using *ForeView*, simply click (right mouse button) on the FORE logo in the upper left corner of the front panel view or select “system” from the pull-down tools menu at the top right of the front panel display.

A screen is then displayed showing the name of the switch, how long it has been running and the versions of hardware and software, as was shown using the AMI command “conf sw sh”.

Displaying SCP Information - AMI

```
myswitch::operation environment>cpu
CPU  Type    CpuStep  State    DRAMSize  FlashSize  BoardRev  PromRev
1X   i960ha      1    normal   16777216  4194304    D         1.1
1Y   i960ha      1    standby  16777216  4194304    D         1.1

myswitch::operation environment>cpu
CPU  Type    CpuStep  State    DRAMSize  FlashSize  BoardRev  PromRev
1X   p55        68    fail     67108864  8388608    A         1.0
1Y   p55        68    normal   67108864  8388608    A         1.0

myswitch::operation flash>free
There are 1891974 bytes of flash still available
```

Core Switch

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The AMI command “operation environment cpu” shows information about the SCPs in the switch to which the AMI connection is made.

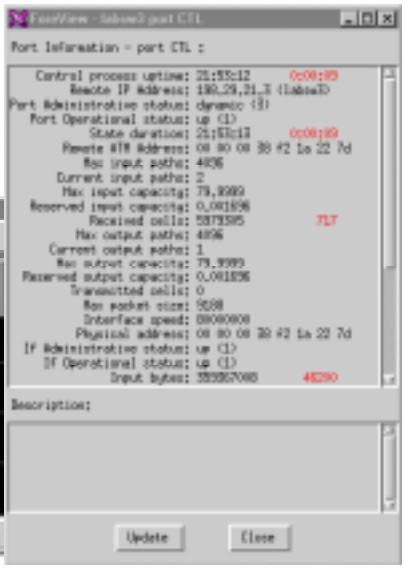
Notice that it gives you information about which Intel processor type is in which SCP slot, and the state of that processor. The state can be “normal” or “standby” for an operational primary or standby SCP, or “fail” if an SCP has failed.

Notice also that you can see the size of DRAM memory and Flash memory that is installed. This display does not indicate how much of that memory is currently used, just how much raw memory was installed originally. You may use the command “oper flash free” to find out how much flash memory is available.

*Note the command also optimizes the flash memory first, and depending on how long it has been since your last optimization, may take several minutes. During this time, the screen shows “Doing Garbage Collection……”.

Displaying SCP Information - *ForeView*

- **Right click on the LED Display (where the switch name would appear) for SCP info**



Core Switch

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Clicking on the LED display area with a right mouse button click brings up a screen of SCP control port information.

Dual SCP Configuration - AMI

```
myswitch::configuration system> dualscp ?
autoremove      autosync        failover        primary
reset           show            switchover      synchronize
threshold

myswitch::configuration system dualscp> sh

                                                Auto      CDB         Sync      Sync
SCP State       Primary  Failover  Threshold    Remove    SyncMode    Requests  Failures
3X  standalone  X        enable    2 secs       disable   automatic   0         0
Synchronization queue:  empty
Synchronization state:  Suspended

myswitch::configuration system dualscp> synchronize (Flash | CDB | LECS |
    OS | Password | Securid | Secret | Init | Loader)

myswitch::configuration system dualscp>
```

Core Switch

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As shown above, the “configuration system dualscp” AMI section allows you access to several areas related to utilizing dual SCPs.

The “show” command allows you to see your current dualscp configuration.

The “primary” command is used to designate which SCP will be utilized initially to control the switch after start-up.

The “failover” command allows you to enable the failover function (i.e. the standby SCP will activate when the controlling SCP fails).

The “threshold” command allows you to designate the amount of time that the standby SCP waits for a heartbeat signal from the controlling SCP before it takes over.

The “autoremove” command enables the standby SCP to automatically remove files or directories if they do not match the files being synchronized with from the controlling SCP.

The “autosync” command enables automatic synchronization of the CDB and password to the standby SCP anytime those files are written to on the controlling SCP.

The “reset” command forces the standby SCP to reboot.

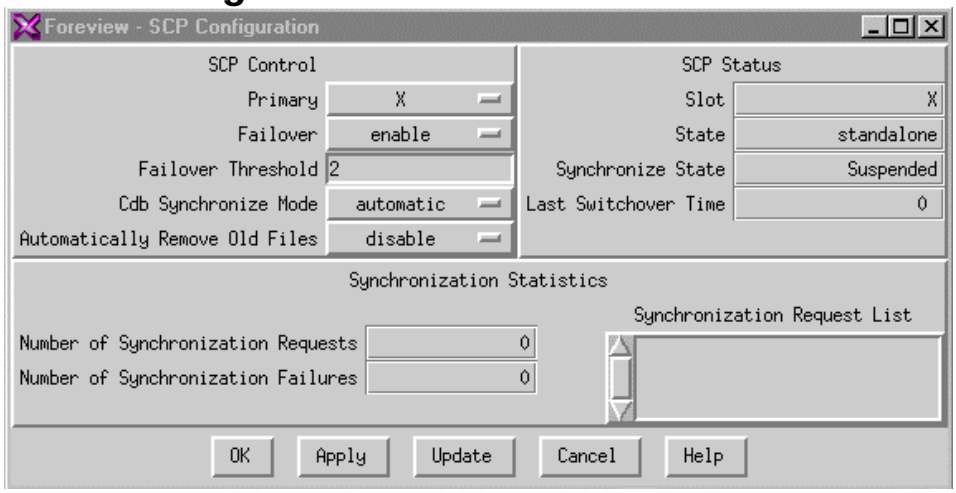
The “switchover” command forces the standby SCP to take over from the controlling SCP.

The “synchronize” command forces SCPs to synchronize one or more of the following items as shown above: Flash, CDB, LECS, OS, Password, Securid, Secret (Securid node secret file) and Loader (Mini Loader). The Init option initializes the Flash memory on the standby SCP.

*Note, once switched from Primary to Standby, the Standby becomes Primary and does not switch back if the original Primary is restored.

Dual SCP Configuration - *ForeView*

- **Right click on the LED Display to select Dual SCP Configuration**



Core Switch

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This screen shows the *ForeView* method of configuring the Dual SCP feature.

The Primary button selects which fabric is primary.

The Failover button is used to enable or disable the feature.

The Failover Threshold represents how many seconds the Standby SCP waits before taking over when the Primary SCP fails.

The CDB Synchronize Mode button enables or disables automatic CDB and Password writing to the Standby SCP whenever the Primary is written to.

The Automatically Remove Old Files button enables or disables that feature on the Standby SCP when it recognizes newer files from the synchronization process initiated by the primary SCP.

Configuring AMI Timeout and UPC Units - AMI

```
myswitch::configuration> system ?
show          dualscp>          prompt          protocol
syslog>       timeout           units

myswitch::configuration system> sh
AMI Session Timeout                             60
File transfer protocol                          tftp
UPC Units                                       cps

myswitch::configuration system> prompt  [-default | <new-prompt>]

myswitch::configuration system> protocol  [ ( ftp | tftp ) ]

myswitch::configuration system> timeout  <minutes>

myswitch::configuration system> units (cps   |  kbps)

myswitch::configuration system>
```

Core Switch

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The “configuration system” command gives you a control of a variety of system level functions.

Besides the previously discussed dualscp function, you may change the prompt displayed by your switch (or align it with the system name), change the default protocol for such transfer functions as cdb backups, perform syslog configuration, change the AMI timeout or the default units for such functions as UPC.

From the “configuration system” AMI screen you may configure the number of minutes of non-activity after which an AMI session (telnet and serial port sessions) will time out and exit you out of the session. A “configuration system show” command will give you the current AMI settings in minutes (the default is 5 minutes). A reading of “0” indicates that AMI will not time out.

The “configuration system show” command also shows the current setting for User Parameter Control (UPC) units (cells per second or Kilobits per second). This setting determines which units are used for configuring and displaying policing parameters related to cell rate (i.e. PCR, SCR, etc).

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Serial Port Configuration - AMI

```
myswitch::configuration> rs232 ?
show              speed

myswitch::configuration rs232> show
Port    Type    Speed    Flow     Bits     Stops    Parity
A       rs232   9600     none     8        one      none

myswitch::configuration rs232> speed (A | B) <speed>

myswitch::configuration rs232>
```

Core Switch

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As shown above, you can determine the communications characteristics of the serial port on your switch by running the command “configuration rs232 show”.

On an LE 155, you may define the speed of the port by using the command “configuration rs232 speed” and entering the desired speed for the serial port. The default SCP serial port speed of 9600 bps on an ASX-200WG/25, ASX-200BX, TNX-210, ASX-1000 or TNX-1100 may not be changed.

Serial Port Usage - *ForeView*

- **Right clicking on the DB-9 Serial port will bring up an AMI command line session on the switch**

```
Trying 198.29.21.3 ...
Connected to london.
Escape character is '^]'.

S_ForeThought_5.1.0 (1.16721) (asx200bx) (london)

login: ami

ATM Management Interface v5.1.0
Copyright (c) 1994-1997 FORE Systems, Inc.

General commands:
  '?' to get list of commands at the current level
  'up' to go up one menu level
  'top' to go to the root menu
  'exit' to leave AMI

Opening a session for "127.0.0.1", please wait...

Connected to "127.0.0.1" (asx200bx).

myswitch::>
```

Core Switch

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Clicking (right mouse button) on the serial port from the front panel display while running *ForeView* is the same as starting a telnet session on the switch whose front panel is displayed.

This allows you full switch access to all AMI commands.

You could also pull down the File menu at the top left of the front panel display and select the “switch” option. This action would result in a telnet session to the switch whose front panel is displayed.

Displaying Module Information - AMI

```
myswitch::configuration> module ?
admin           reset           show            traffic>

myswitch::configuration module> sh
Module Series  Admin  Speed   Ports  Timing  Rev  Serial#  ProductNumber
1A     C2      up     1.544   6      yes     1.0  N/A      NMCE-6 / DS1C
1B     C       up     2.048   6      yes     1.0  N/A      NM-6 / E1C
1C     C       up     100.0   6      no      1.0  N/A      NM-6 / 100MMSCC
1E     B       up     2560.0  4      yes     1.0  N/A      NM-4 / BPB

myswitch::configuration module>reset 1c
Resetting the network module will destroy the
existing connections temporarily.
Reset the network module [n]? y

myswitch::configuration module>
```

Core Switch

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Typing “conf mod sh” under AMI shows each module installed on this switch and some specific details about each module.

Notice that there are several different types of netmods, each with its own series designation, info rate per port and even support or lack of support for distributed timing. C2 designates a Circuit Emulation module

If you would like to reset a netmod or perform tests offline, you should first admin the netmod down with the following command:

myswitch::configuration module> ***admin <netmod#> down***

You can then reset the netmod without affecting the other netmods in that switch. This action is the same as removing and replacing the netmod with power applied. All connections will be torn down and rebuilt as necessary.

The “configuration module traffic” command is used to configure or display information in regards to traffic management parameters associated with each specific type of netmod. For more detail on this area, refer to the AMI Configuration Commands Reference Manual.

Displaying Module Information - *ForeView*

- **Use the Front Panel Display**
- **Select a port and pull down Configure Module**

Core Switch

1/22/98 2-41

At a module level, *ForeView* allows only two options; configuring support for distributed timing and configuring support of different traffic models.

However, the front panel display itself provides a wealth of information visually. It shows what type of modules are installed in each slot (including their model designation), which connectors are active and even the name of the device to which each port is attached.

Displaying Port Information - AMI

```
myswitch::configuration> port ?
aal5packetdiscard      admin              aisrdi             cac
cdvt                   cesds1>            cese1>             delay
ds1>                   ds3>               e1>                e3>
gcrapolicing           j2>                led>               policing
pppolicing             show               sonet>             taxi>
tp25>                  traffic>           ubrtagging         vbrbuffob
vbrob

myswitch::configuration port>show  1A2
Port  Carrier  Admin  Mbps  ATM-Rate  CDVT  Policing  VBROB  BuffOB  AIS/RDI  Model
1A2   yes      up     155.0   149.8   250   enabled    100    100    disabled OC3

myswitch::configuration port>show  1A2 tm
                    GCRA Policing    AAL5  PP Pol.   AAL5  Packet Discard     Tag All
Port   CAC          CBR     VBR      CBR   VBR       CBR   VBR     UBR        UBR
1A2    disabled     svcOn   svcOn    allOff allOff     svcOn svcOn   svcOn     svcOff
```

Core Switch

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The AMI command “conf port ?” shows all the sub-commands in the port area. Notice that specific port type (i.e. ds1, etc.) sub-commands are combined with specific functional commands (i.e. traffic). We will be covering several specific types of ports in the following slides.

Notice also that the show command can be used to show all port information or just the information related to a certain port.

Notice also that by applying the tm (traffic management) extension to the show command allows viewing of traffic management specific information about a port. For each column (except Poort and CAC), the choices are allOn, allOff, svcOn, svcOff or N/A. Each of these selections means either all connections or just SVC connections of the type indicated by the column sub-heading (i.e.. CBR) are to be subjected to the particular policing process shown in that column’s main heading (i.e. GCRA Policing). For PVC connections, the UPC contract for that particular connection determines the exact policing parameters.

Although normally enabled, CAC may be disabled on a per port basis. This allows you to overbook sporadic CBR traffic.

Displaying Port Information - *ForeView*

- **Configure a port or multiple ports selected from the Front Panel. Ports can be selected using the Edit pull-down menu or by double-clicking any port on the front panel. Ports can be configured using the Configure and then Port pull-down menus.**

Core Switch

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To configure ports using *ForeView*, either select the port using the Edit pull-down menu or double click the specific port.

Once selected, ports may then be configured using the Configure Port pull-down menus. Each port type is shown and may be selected for configuration as detailed in the following slides.

The Generic selection, under Port, when selected, displays a screen of overall port information (similar to the AMI command “conf port show”).

Configuring SONET Ports - AMI

```
myswitch::configuration port> sonet ?
emptycells      loopback        mode            scrambling
show            timing

myswitch::configuration port sonet>sh 4c1
Port  Width  Line  Mode   Loopback  Timing    Scrambling  EmptyCells
4C1   sts3c  MM    sonet  none      internal  on          unassigned

myswitch::configuration port sonet>sh 4c1 status
Port  Carrier  Section  Line  Path  Atm
4C1   yes      0x1      0x1   0x1   0x1
```

Core Switch

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By typing the AMI command “conf port sonet ?” you can see each item that is configurable for sonet interfaces.

Emptycells are sent as filler for those connections requiring end-to-end timing synchronization. They are designated unassigned (CLP=0) by default or idle (CLP=1) on a per port basis.

Per port line/diag/path loopbacks may be assigned to isolate problems to the network/netmod port/OC-12 path.

The mode may be set on a per port basis to sonet (US) or sdh (synchronous digital hierarchy common in Europe).

Scrambling of the ATM cell payload may be enabled on a per port basis (should be set to the same on each end of the network).

On a per port basis, timing may be selected as internal (default) or network, where the receive timing on that port is used as the transmit timing reference.

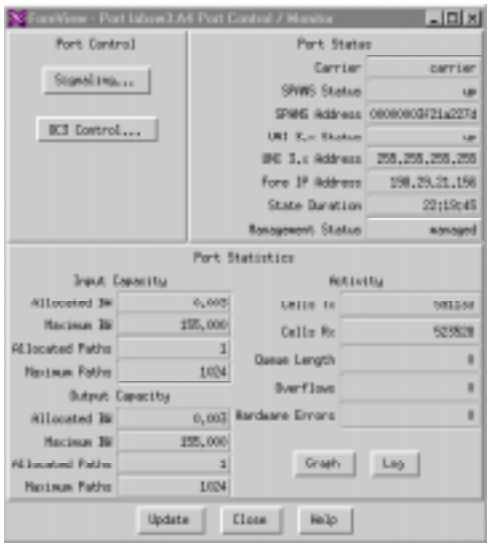
By typing “conf port sonet sh [port#]” you are able to see how all (or designated) ports are configured. Width reflects the line rate. Line reflects the interface type (SMSR, SMIR, other, MM or UTP).

By typing “conf port sonet sh [port#] status” you are able to see sonet specific information. The display in each column represents a summation of the following possible conditions:

Section/Line/Path/Atm - no problem = 1
Section LOS/LineAIS/Path LOP/Atm LCD = 2
Section LOF/Line RDI/Path AIS = 4
Path RDI = 8
Path not provisioned = 16
Path Signal Label Mismatch = 32

Configuring SONET Ports - *ForeView*

- **Single click on any port to select it. Use the right button of the mouse to bring up an options list. Choose Port Status to give relevant port control information.**



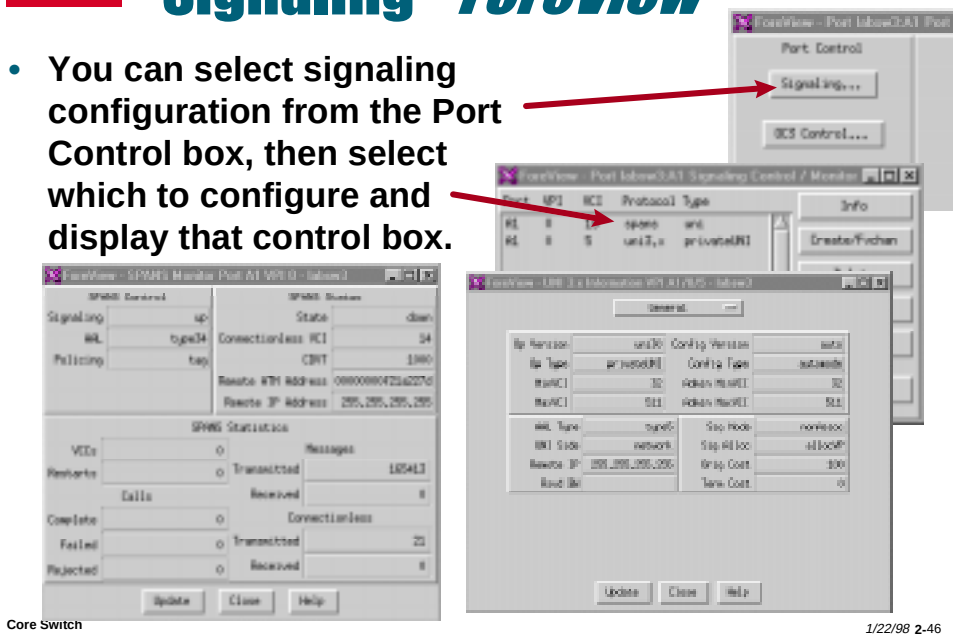
To configure ports using *ForeView*, click on a port from the front panel display to select the port.

Then click on the right mouse button to choose Port Control.

A screen will appear which contains port status and statistical information. You have the option of updating the display, or choosing to configure signaling or port media.

Configuring SONET Port Signaling - *ForeView*

- **You can select signaling configuration from the Port Control box, then select which to configure and display that control box.**



Core Switch

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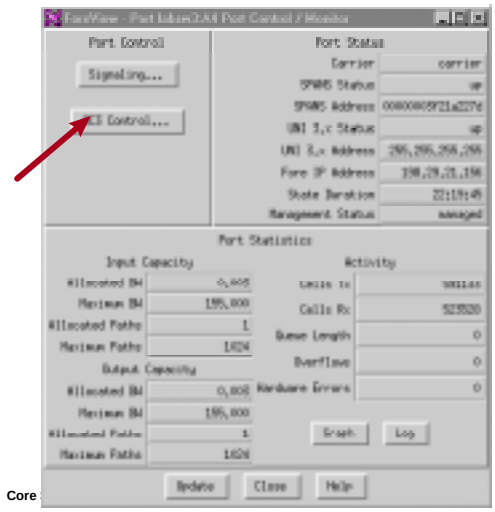
If you choose to configure signaling, the Signaling Configuration dialog box appears.

Choose which type of signaling you would like to configure and click on the info button to bring up the appropriate signaling control screen.(SPANS signaling control screen is shown on the left and the UNI signaling control screen is shown on the right).

Configuring SONET Port Media - *ForeView*

- **You can also select media control from the Port Control box to display the media control box.**



To configure the physical media, from the port control screen, click on the media control button to bring up the appropriate media control screen.

Notice that on this screen you see status and statistics information related to this specific type of port media.

Configuring Other Port Types

- **AMI/*ForeView* methods are same as for SONET ports**
  - **Exception is TAXI, whose media is not configurable**
- **Following slides are AMI methods for…**
  - **ATM DS3**
  - **ATM DS1**
  - **CES DS1**

All other port types are configured using very similar methods and *ForeView* screens.

An exception is TAXI, whose physical media is not configurable through AMI or ForeView.

Configuring DS3 Ports - AMI

```
myswitch::configuration port> ds3 ?
emptycells      framing         length          loopback
mode            scrambling      show            timing


myswitch::configuration port ds3>sh
Port Carrier Status Mode  Framing Loopback Timing   Scrambling EmptyCells Length
1A1  yes     0x1    plcp  cbit    none     internal off        unassigned  Gt225
1A2  yes     0x1    plcp  cbit    none     internal off        unassigned  Gt225
```

Core Switch

1/22/98 2-49

By typing the AMI command “conf port ds3 ?” you can see each item that is configurable for ds3 interfaces.

The mode may be set on a per port basis to plcp (Physical Layer Convergence Procedure) or hcs (Header Check Sequence) based framing for cell delineation The default is hcs.

DS3 framing may be designated on a per port basis as cchannel (clear channel M23) or cbit (cbit parity) which is the default.

Per port cell/payload/line/diag loopbacks may be assigned to isolate problems to the network/netmod port.

On a per port basis, timing may be selected as internal (default) or network, where the receive timing on that port is used as the transmit timing reference.

Scrambling of the ATM cell payload may be enabled on a per port basis (should be set to the same on each end of the network).

Emptycells are sent as filler for those connections requiring end-to-end timing synchronization. They are designated unassigned (CLP=0) by default or idle (CLP=1) on a per port basis.

Line length may be designated on a per port basis to adjust to the length of the cable attached to the port (Lt225 if the cable is shorter than 225 ft. / Gt225 if the cable is longer than 225 ft.). Gt225 is the default.

Configuring ATM DS1 Ports - AMI

```
myswitch::configuration port> ds1 ?
emptycells      length          loopback        mode
prbs            scrambling      show            timing


myswitch::configuration port ds1>sh
Port  Carrier  Status  Mode  Framing  Loopback  Timing    PRBS  Scram  Length  EmptyCells
4C1   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
4C2   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
4C3   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
4C4   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
4C5   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
4C6   yes      0x1     hcs   ESF      none      internal  off   off    Lt110   unassigned
```

Core Switch

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By typing the AMI command “conf port ds1 ?” you can see each item that is configurable for ds1 interfaces.

The mode may be set on a per port basis to plcp (Physical Layer Convergence Protocol) or hcs (Header Check Sequence) based framing for cell delineation The default is hcs.

ESF (Extended Super Frame) is the default framing structure.

Per port payload/line/diag loopbacks may be assigned to isolate problems to the network/netmod port. Pseudo-Random Bit Sequence (PRBS) generation is available also on a per port basis.

On a per port basis, timing may be selected as internal (default) or network, where the receive timing on that port is used as the transmit timing reference.

Scrambling of the ATM cell payload may be enabled on a per port basis (should be set to the same on each end of the network).

Line length may be designated on a per port basis to adjust to the length of the cable attached to the port (Lt110 if the cable is shorter than 110ft / 110-220 / 220-330 / 330-440 / 440-550 / 550-660 / and Gt655 if the cable is longer than 655ft.).

Emptycells are sent as filler for those connections requiring end-to-end timing synchronization. They are designated unassigned (CLP=0) by default or idle (CLP=1) on a per port basis.

Configuring CES DS1 Ports - AMI

```
myswitch::configuration port> cesds1 ?
admin                    framing                  length           linestatus
loopback                 mode                     show

myswitch::configuration port cesds1>sh
Port          Framing  Carrier  Line   Loopback  Port      Line     Line
              Mode     State    Code   State     Timing    Length   Status
2A1   up      ESF      yes      B8ZS   none      internal  <130     0x1
2A2   up      ESF      yes      B8ZS   none      internal  <130     0x1
2A3   down    ESF      no       B8ZS   none      internal  <130     64
2A4   down    ESF      no       B8ZS   none      internal  <130     64
2A5   down    ESF      no       B8ZS   none      internal  <130     64
2A6   down    ESF      no       B8ZS   none      internal  <130     64

myswitch::configuration port cesds1>linestatus
                Rx    Tx    Rx    Tx
Port  Alarm     LOF   LOF   AIS   AIS   LOF   LOS   Loopback
2A1   no        no    no    no    no    no    no    off
2A2   no        no    no    no    no    no    no    off
2A3   no        no    no    no    no    no    yes   off
2A4   no        no    no    no    no    no    yes   off
2A5   no        no    no    no    no    no    yes   off
2A6   no        no    no    no    no    no    yes   off
```

Core Switch

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By typing the AMI command “conf port cesds1 ?” you can see each item that is configurable for cesds1 interfaces.

The Port column indicates the port number and its state.

The framing mode may be set on a per port basis to SF (Super Frame or ESF (Extended Super Frame).

The Line Code may be set on a per port basis to either B8ZS (Binary 8-Zero Substitution) or AMI (Alternate Mark Inversion).

A per port line loopback may be assigned to isolate network problems.

On a per port basis, timing may be selected as internal (default) or network, where the receive timing on that port is used as the transmit timing reference.

Line length may be designated on a per port basis to adjust to the length of the cable attached to the port (<130 if the cable is shorter than 130ft / 130-260 / 260-390 / and >390 if the cable is longer than 390ft.).

The Line status column represents a summation of the following possible conditions:

No alarm = 1
Receive LOF = 2
Transmit LOF = 4
Receive AIS = 8
Transmit AIS = 16
CES LOF = 32
CES LOS = 64

By typing “conf port cesds1 linestatus” you can get an individual port and alarm status plus an indication of loopback status.

Configuring Port LED Indication - AMI

```
myswitch::configuration port> led ?
model           show

myswitch::configuration port led> model <port> (lan1 | wan1 | lan2 |
    wan2)

myswitch::configuration port led>show
Port    Type          rxLED  txLED  Model
1B1     OC3           auto   auto   lan1
1B2     OC3           red    auto   lan2
1B3     OC3           red    green  wan1
1B4     OC3           red    yellow wan2
```

Core Switch

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For Series C, LC and D netmods, the LEDs associated with each port's transmit and receive connection can be configured to represent one of four different models.

Typically, LAN port LEDs blink to indicate traffic flow, while WAN port LEDs illuminate solid green unless an error condition is encountered on that port.

For the lan1 and wan1 models, "red" means a fault in the receive direction, "yellow" means a fault in the transmit direction and "green" means no fault. "auto" indicates that the LED is under hardware control and is normally dark with green blinks to indicate traffic flow. For these two models, only the receive LED color changes. "lan1" is the default mode.

For the lan2 and wan2 models, "red" means a line fault, "yellow" means a path fault and "auto/green" means no fault. For these two models, both transmit and receive LEDs may change color, but faults in the receive direction may mask some transmit faults.

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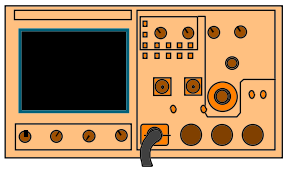
Switch, Module and Port Statistics

- **May be used as a diagnostic or installation/configuration verification tool**
- **ATM Layered Statistics**
- **Connection Statistics**
- **Product Statistics**
  - **Board/Fabric**
  - **Module**
  - **Port**



Core Switch

1/22/98 **2**-54

By examining the available switch statistics, the user can determine if the switch or any of the installed modules, ports, paths and channels are operating properly.

Statistics (board/module) - AMI

```
myswitch::statistics> ?
aal0                aal4                aal5                atm
atmroute>           board               cec>                cese1
cesds1              ces                 cr                  ctlport
icmp                interface           ip                  ipaccess
module              nsapfilter>         oam>                port
spans               tcp                 udp                 signalling
vcc                 vpc                 vpt

myswitch::statistics>board
Board       VPI-Lookup-Errors                VCI-Lookup-Errors
1                         1241                              562

myswitch::statistics>module 1A
Module  Priority    Status      Size    Qlength          Overflows
1A      0           enabled     512           0                  0
1A      1           enabled     512           0                  0

myswitch::statistics>module traffic 2B
Module  Model  Ucasts  Mcasts  Mouts  Cells  Shared    Used
2B          2      30       1      6      0    7392       4
```

Core Switch

1/22/98 2-55

Statistics may be gathered for a large number of items using the “statistics” AMI command.

You may gather statistics related to the ATM layered model (i.e. aalx, atm and physical layers).

You may gather statistics related to virtual connections (i.e. vcc, vpc and vpt).

You may gather statistics related to signaling (i.e. spans or uni).

You may gather statistics related to the IP stack running on the switch fabric (i.e. icmp, interface, ip, tcp or udp).

Or, as in the case of installation and/or configuration verification you may gather statistics related to the switch product itself (i.e. board, module as shown above and port as shown on the next slide). Note that only Series C, LC and D netmods support the traffic extension. Note also that the Circuit Emulation service/port information is separate from the rest of the port information.

Statistics (port) - AMI

```
myswitch::statistics>port
        Input                  Output                    Cells        Cells
Port  VPs   VCs      BW  VPs  VCs       BW   Received  Transmitted  ErrSecs  Overflows
1A1     1     6    0.8K    1    6     0.0K          0       742025        0          0
1A2     1     6    0.8K    1    6     0.0K          0       742025        0          0
1CTL    1    12    0.0K    1   14     0.0K    2756927      1283307        0          0

myswitch::statistics>port sonet
sonet  Port  1D1  Counter                 Value              Delta
sonetSectionBIPs                     1571776380             863766
sonetSectionLOSs                          32745                 18
sonetSectionLOFs                          32745                 18
sonetLineBIPs                                 0                  0
sonetLineFEBEs                                0                  0
sonetLineAISs                             32745                 18
sonetLineRDIs                                 0                  0
sonetPathBIPs                                 0                  0
sonetPathFEBEs                                0                  0
sonetPathLOPs                                 0                  0
sonetPathAISs                             32745                 18
sonetPathRDIs                             32745                 18
Press return for more, q to quit:
```

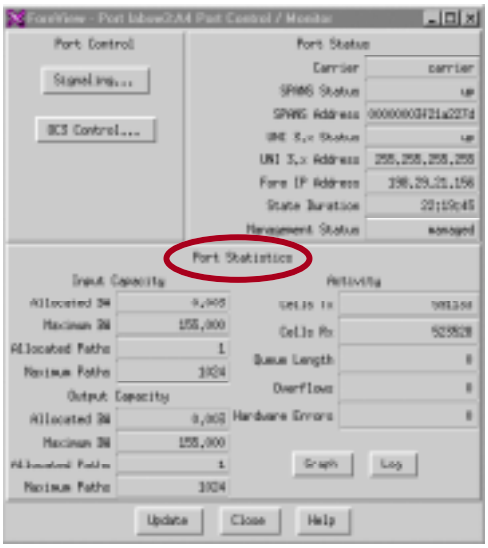
Core Switch

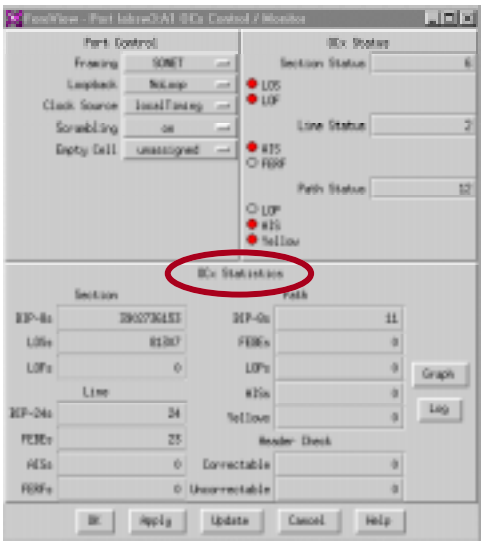
1/22/98 **2**-56

Overall port statistics can be obtained by typing the AMI command "statistics port". Overflows indicate the number of cells dropped on this port because the output buffer was full.

To get more specific statistics related to a particular port type, type the AMI command "statistics port <port type>". In the example above, sonet specific information is presented, such as Section, Line and Path information.

Statistics (port) - *ForeView*





Core Switch

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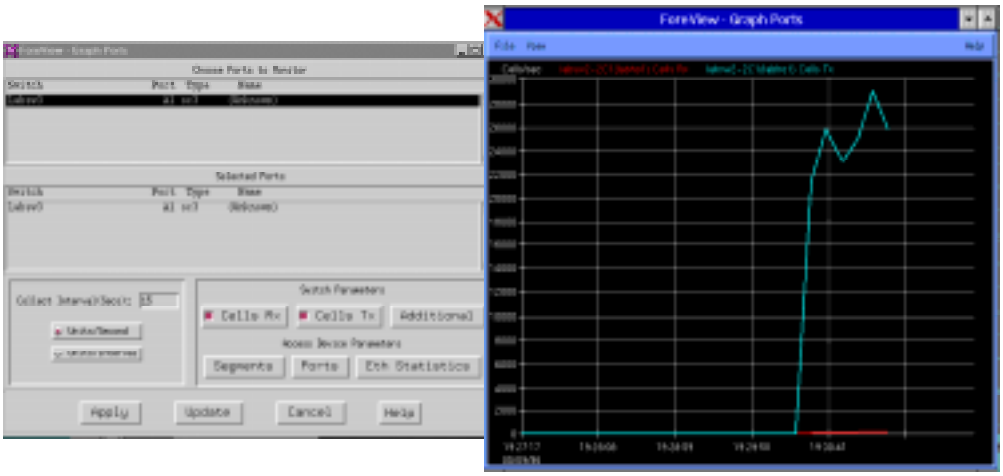
Notice that Port related *ForeView* statistics are collected on the Port Control screen and on the Media Control screen.

Notice also that there is a Graph and a Log button on each of these screens to allow graphing or logging of the statistical data.

These features are shown on the next two slides.

Port Graphing - *ForeView*

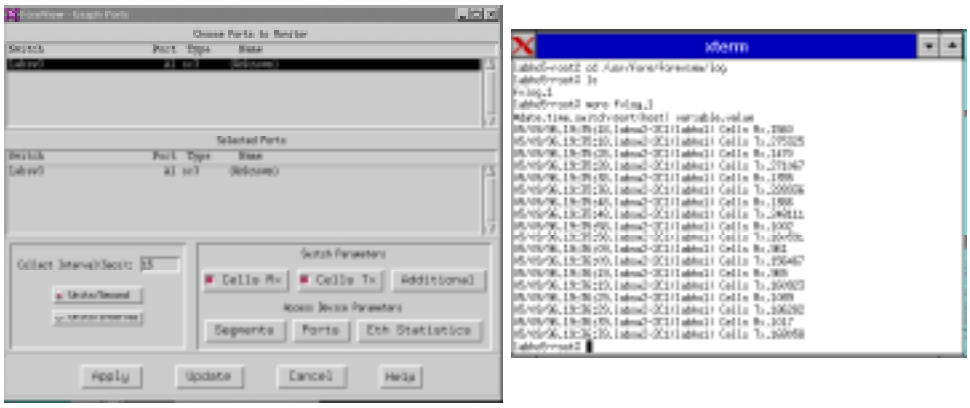
- **The Graph dialog box will yield the graph.**



When you select Graph from the Port Control screen, the Graph Tool dialog box appears, which allows you to select which items will be graphed.

Port Logging - *ForeView*

- **The logging dialog box is very similar to the graphing box.**



Core Switch

1/22/98 **2-**59

When you select Log from the Port Control screen, the Logging dialog box appears, which allows you to select which items will be logged and the logging interval.

All logged items will be stored as comma-delimited text files in the foreview directory under /log/fvlog.1.

ASX Installation Verification

- Switch powers up OK (LEDs/display)
- Switch accepts serial port configuration
  - Switch name and IP address
- AMI/*ForeView* verifies modules/ports
  - “conf mod sh” and “conf port sh”
- AMI/*ForeView* verifies info flow
  - “statistics port”
- AMI/*ForeView* verify OS version
  - “conf sw sh”

Core Switch

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After installing and potentially configuring any FORE ATM switch, use the above steps to verify the installation.

The front panel LEDs or display may be used to prove that the hardware and software came up OK when power was applied.

Port LEDs may be used to determine polarity problems.

If your user interface (AMI or *ForeView*) locates the switch, you can use either to verify all modules and ports.

You can use statistics to verify that information is flowing through a port.

Finally, you can use AMI or *ForeView* to verify what OS you are running

Switch Installation & Configuration Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. What are the default settings used for configuring your console to communicate with the ASX switch product line?

2. What is the interface designation for a Classical IP interface? _____

   FOREIP interface? _____ Emulated LAN interface? _____

3. Can you adjust the delay the standby SCP waits before taking over for the primary SCP in the event of a primary SCP failure? Yes / No

4. What is the default reserved VCI range for Point to Multipoint connections? _____

5. User ids other than AMI and ASX can be assigned Admin privileges?

   True/False

6. How would you determine if there are OC-3 LOS/LOF section errors using ForeView?

   Using AMI?

7. The AMI command “statistics” is a submenu item under the AMI command “configuration”. True / False

8. What AMI command line do you type to find VPI-lookup-errors?

9. What AMI command line do you use set the switch name?

   a. configuration switch name <name>
   b. conf name
   c. oper switch name
   d. oper flash name

10. Initial configuration of an ASX switch can be performed through the Ethernet port on the Switch Control Processor (SCP). True / False

Switch Installation & Configuration (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. What are the default settings used for configuring your console to communicate with the ASX switch product line? **9600 8 N 1**

2. What is the interface designation for a Classical IP interface? **_qaa0**

   FOREIP interface? **__asx0__** Emulated LAN interface? **__elx___**

3. Can you adjust the delay the standby SCP waits before taking over for the primary SCP in the event of a primary SCP failure? **Yes** / No

4. What is the default reserved VCI range for Point to Multipoint connections? **155-255**

5. User ids other than AMI and ASX can be assigned Admin privileges?

   True/False

6. How would you determine if there are OC-3 LOS/LOF section errors using ForeView?
   Highlight port, right click, select media (OC3) control

   Using AMI? **"statistics port sonet"**

7. The AMI command "statistics" is a submenu item under the AMI command "configuration". True / **False**

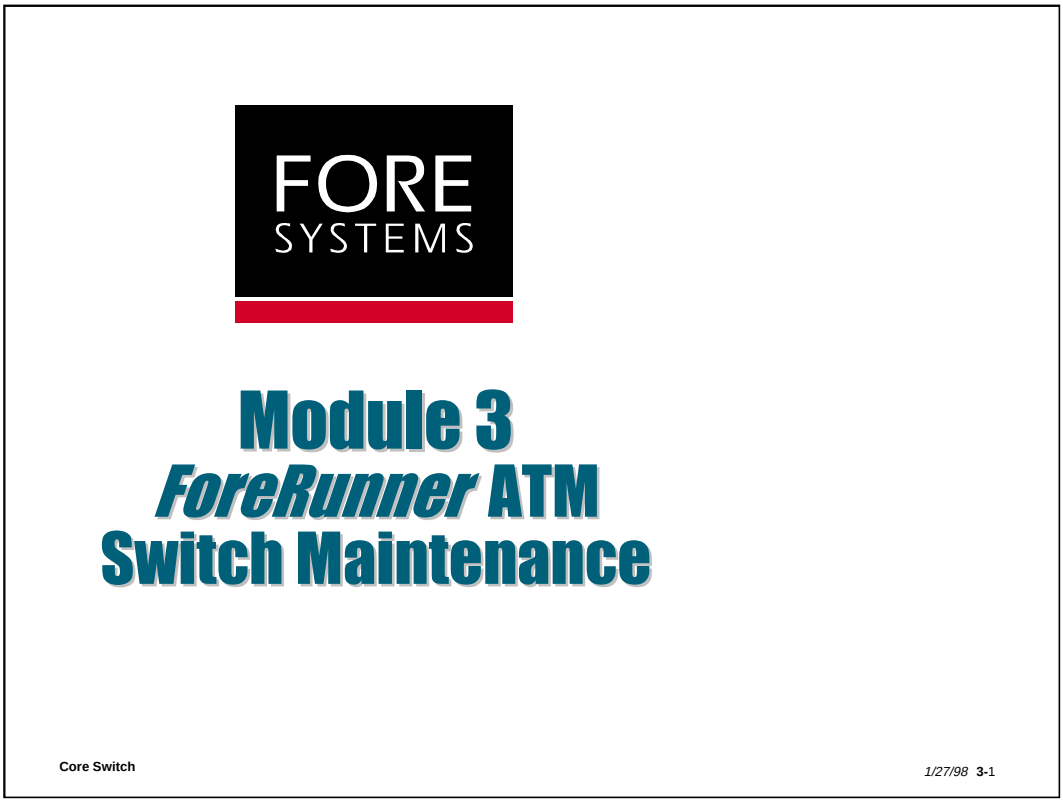
8. What AMI command line do you type to find VPI-lookup-errors?

   "statistics board"

9. What AMI command line do you use set the switch name?

   a. **configuration switch name <name>**
   b. conf name
   c. oper switch name
   d. oper flash name

10. Initial configuration of an ASX switch can be performed through the Ethernet port on the Switch Control Processor (SCP). True / **False**


FORE
SYSTEMS
Module 3
ForeRunner ATM
Switch Maintenance
Core Switch
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Component Replacement

- **Netmods on all switches except LE155 are hot swappable**
- **i960ha & Pentium SCPs are hot swappable**
- **Switch boards (fabrics) on MSC-900s, ASX-1000s & TNX-1100s are hot swappable**
- **Fan Tray on MSC-900, ASX-1000 & TNX-1100 is hot swappable***
  - *** - Should be completed in 15-20 minutes**
- **Power Supplies on all switches except LE155 and ASX-200WG/25 are hot swappable**
- **CEC+ (TCM) on MSC-900 and TNX-1100 is hot swappable**

With the exception of the LE155, all switches contain netmods which are hot swappable. Netmods (and ports) can be “admin’d” down for testing purposes (or netmod removal) and netmods can be “reset”, which performs the same functions as swapping the netmod with power applied.

Both i960ha and Pentium SCPs may be hot swapped, and both are capable of “dualscp” configuration and operation. In the case of single SCP operation, if an SCP is removed with power applied, new VCs will not be able to be built, SVC connections will begin to be taken down as their signaling link status messages are not processed, but PVCs may remain for some time. This is because the SCP is only involved in the signaling, setup and status processing of VCs, not cell flows.

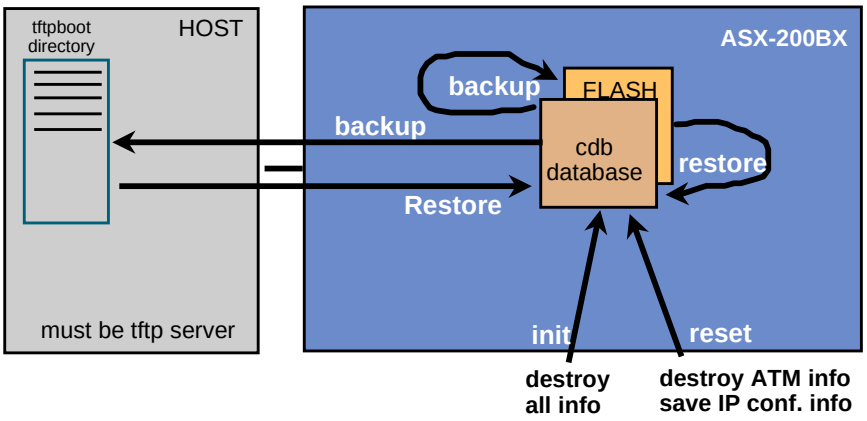
Entire fabrics are hot swappable on the multi-fabric switches, in the case where the fabric (switch board) itself has faulted.

Fan trays are hot swappable, and for those sites containing a large number of multi-fabric switches, it would make sense to have a spare fan tray on site.

With the exception of the LE155 and ASX-200WG/25, who only have one power supply, all other switches have hot swappable power supplies in either AC or DC configuration.

The CEC+ contains two Timing Control Modules (TCMs) which are hot swappable in the event of a failure.

Configuration Database Operations



Core Switch

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The drawing above shows the four different operations available under operation cdb:

backup

restore

reset

init

The Switch Configuration Database is used to store user configurable parameters such as, Port SPANS State, PVC entries, etc. You may choose to have multiple database files stored in flash memory on the switch, or alternatively, on a remote host. This function allows you to use different configurations when required, as well as keeping a back-up of configuration changes in the unlikely event of a switch failure.

If you wish to remove entries from the configuration database, you must either manually delete them through AMI, or by choosing reset (or init), you may delete the entire database.

CDB Backup and Restore

```
myswitch::operation cdb> ?
  backup        init          reset         restore

myswitch::operation cdb> backup?
usage: backup [<host>]:<full path to backup file>

myswitch::operation cdb> backup 198.29.21.158:/tftpboot/bob
or
myswitch::operation cdb> backup bob

CDB backup was successful


myswitch::operation cdb> restore?
usage: restore <full path to backup file> [<host>]

myswitch::operation cdb> restore 198.29.21.158:/tftpboot/bob
```

Core Switch

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Notice than when you choose to backup or restore the database to/from a remote host, you must give the full path and filename to the backup file, while if you are backing up to or restoring from flash memory you may simply enter the file name/s. On the switch you can use “operation flash dir” to see a list of cdb files in flash memory, however, there is currently no editing capability within flash memory. Of course when backed-up to a remote host, you may list and manipulate these files as usual per that workstation type.

It is important to note that when restoring a configuration database from a file or a remote host, the switch control software will be halted and restarted. Be sure that your system can tolerate a momentary drop-out before performing this operation.

When using multiple database files, be sure to store them under different file names.

Before backing up your CDB to a remote Sun host using the tftp protocol, you must create an empty file using that same name in the tftpboot directory of the host that you will be using for backup. For the examples shown above, perform the following steps:

Change to the tftpboot directory - **cd /tftpboot**

Create an empty file called bob - **touch bob**

Allow the switch to write to bob - **chmod 777 bob**

CDB Reset and Init

```
myswitch::operation cdb> ?
  backup        init          reset         restore

myswitch::operation cdb> reset

********** W A R N I N G **********
This operation resets the switch configuration database.
As a result, the switch control software will be restarted.
You will lose connectivity with the switch while this
operation is progressing.

Are you sure you want to reset the CDB [n]? y
The switch will restart momentarily.
```

Core Switch

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The “reset” option allows the user to remove all database information (i.e. PVCs), while maintaining all switch interface and associated IP address information.

The “init” option will completely remove all the database information, including IP addresses assigned to the switch interface(s). If you do not wish to remove the IP configuration of the switch, choose the reset option rather than init.

The response to the issuance of the “operation cdb init” command is different from that of the “operation cdb reset” command stating:

This command will re-initialize the CDB and reboot the switch
Do you really want to remove ALL permanent information from the database INCLUDING the configuration of all the network interfaces? (n)

After initing you will have to use the serial port to access the switch, as all previously configured data over ATM or Ethernet interfaces will be unconfigured.

Managing the Flash File System

```
myswitch::operation flash> ?
  copy        delete      dir         free
  get         init        put         rename

myswitch::operation flash> dir
LECS.CFG
FT5.0/
FT5.1/
CURRENT

myswitch::operation> version
Software versions installed : FT5.0  FT5.1
Current software version is FT5.1

myswitch::operation flash>del ft5.0/foreos.exe
myswitch::operation flash>del ft5.0
```

Core Switch

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The flash file system of FORE ATM switches allows the user to store multiple versions of the switch software. In some cases, it is possible to retain two or more versions of the software at the same time, plus cdb and lecs.cfg information (remember, while the i960ha has 4M of flash, the Pentium has 8M). Below is a description of the commands used to manipulate the flash memory contents:

copy - allows the user to copy a file in the flash system to another file.

delete - allows the user to delete a file from the flash memory system.

dir - allows the user to list the files currently in the filesystem.

free - displays the amount of free space left in the flash memory system.

get - allows the user to retrieve a file from a server. The command will need the full path to the host and the filename to be retrieved.

put - allows the user to transfer a file to a server. The command will need the local file name, and the full path to the server as well as the filename to be saved on the server.

rename - allows the user to rename a file stored in the flash memory system.

There should always be a file in the flash memory called CURRENT. This is a pointer to the version of the software that is currently running on the switch. To find out which version this is, enter the <operation version> command. When this command is given, the switch will show the currently running software version, as well as any other versions of the software stored in the flash memory system (similar to <operation flash dir>).

To delete a *ForeThought* operating system file from flash you must first delete the actual executable (foreos.exe) as shown above, and then delete that file's name directory (ft5.0) as shown above.

Upgrading the Switch Control Software

- **Upgrade software comes on floppy disks, CD-ROM or can be obtained via FTP**
- **Unload floppy disks or FTP file onto a workstation on the same network as the switch to be upgraded (ATM or Ethernet)**
- **Set-up a tftpboot server on the machine that contains the software images**
- **Upgrade file retrieved over the network and installed automatically**

Core Switch

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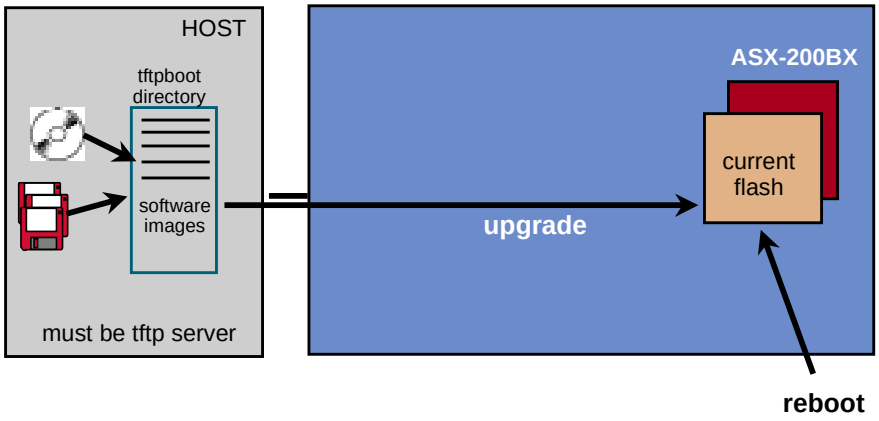
The procedure for upgrading the Switch Control Software is described in detail in Chapter 4 of the *ForeRunner* ATM Switch Installation and Maintenance Manual.

The upgrade file may be sourced from FORE's Web site by doing an FTP to ftp.fore.com and logging in as anonymous. Use your full email address as the password. At the ftp> prompt change to the /priv/release/sunny directory, which contains the upgrade and readme files. FORE TAC will supply you with the correct software and readme file name, as they are not displayed or listed. Readme files are ASCII text and so may be loaded directly. You must be in binary mode to FTP the software files. If the file has a Z extension it is compressed and must be uncompressed before upgrading. Once uncompressed (if necessary) upgrade files should be placed in the tftpboot directory for proper upgrading through AMI.

Sourcing the upgrade file from floppy diskette or CD-ROM is discussed on the next page.

Software upgrade from diskette or CDROM



Core Switch

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Before upgrading software, the software image must be put into a tftpboot directory on the host.

The software image is a file with a name such as ASX-200BX_<version> or ASX_i960_<version>.

You will need the filename and path to tftpboot later when you actually perform the the upgrade procedure.

Upgrading Over the Network

```
myswitch::operation> upgrade 198.29.21.158:/asx-i960_5.1.0_1.16721
Received 1849280 bytes in 13.9 seconds
upgrade successful
Reboot the switch [y]?

myswitch::configuration system dualscp>synchronize OS
```

Core Switch

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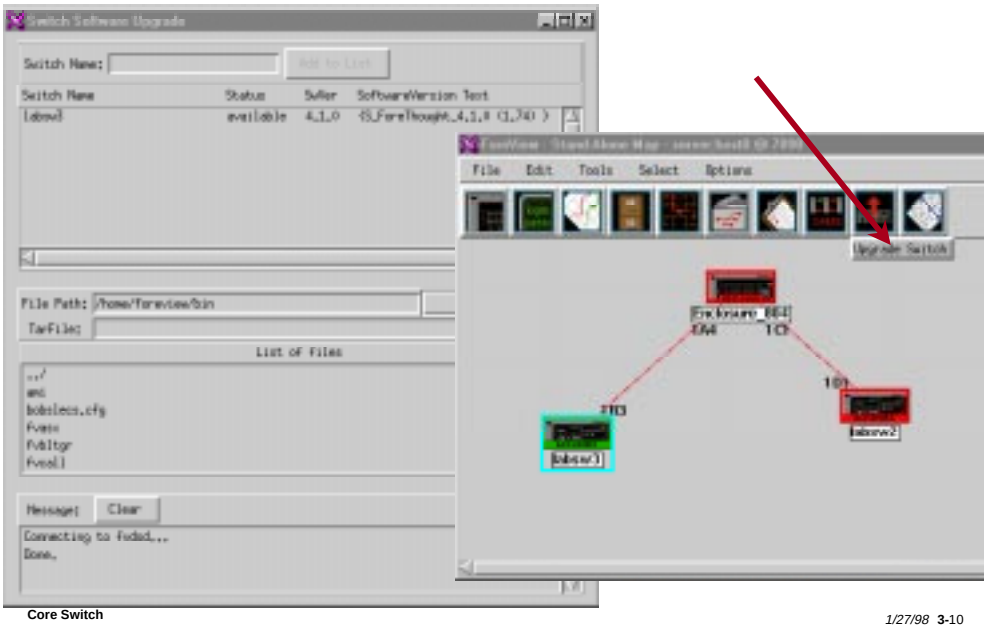
The AMI command “operation upgrade” allows the user to upgrade the switch software. When the command is issued, AMI looks for the designated software images in the tftpboot directory of the designated workstation. When the file is sent to the switch, AMI will inform you that the switch must be rebooted before the new software is used, and will give you a prompt to confirm the reboot before performing it.

Notice that the full pathname to the software on the remote host must be given, along with the IP address of the remote host. The host that contains this software must also be configured to be a tftpboot server.

If there is not enough room in FLASH to hold the new operating system, the resident OS will be deleted as the new OS is loaded into FLASH.

If you are using redundant SCPs, you can upgrade the secondary SCP by forcing it to synchronize with the primary by performing the command above. Note that if you are going to issue the “switchover” command to try out the new OS on the secondary SCP, you should also synchronize CDBs, password files, etc.

Upgrading with *ForeView*



Core Switch

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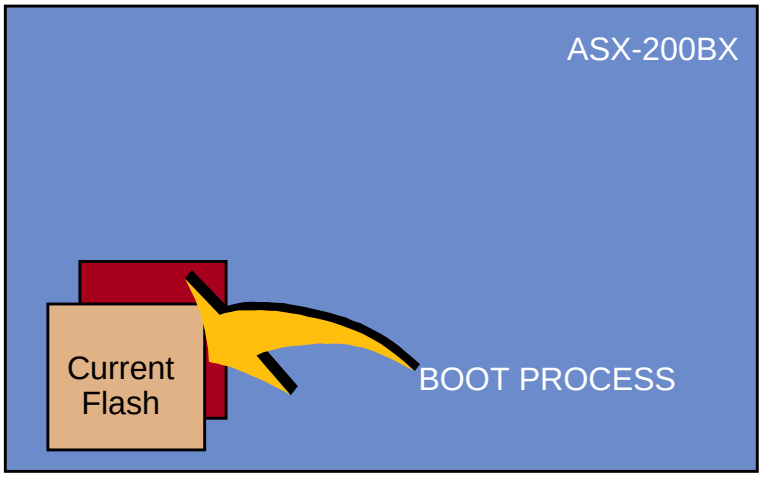
To upgrade with *ForeView*, select the Upgrade icon from the FVMAP screen and you will see a list of the switches preselected on the fvmap.

Any or all switches with at least FT 4.1 software may be selected for upgrade with the tar file (and path to the tar file) listed at the middle of the Software Upgrade screen.

Normal boot operation



Core Switch

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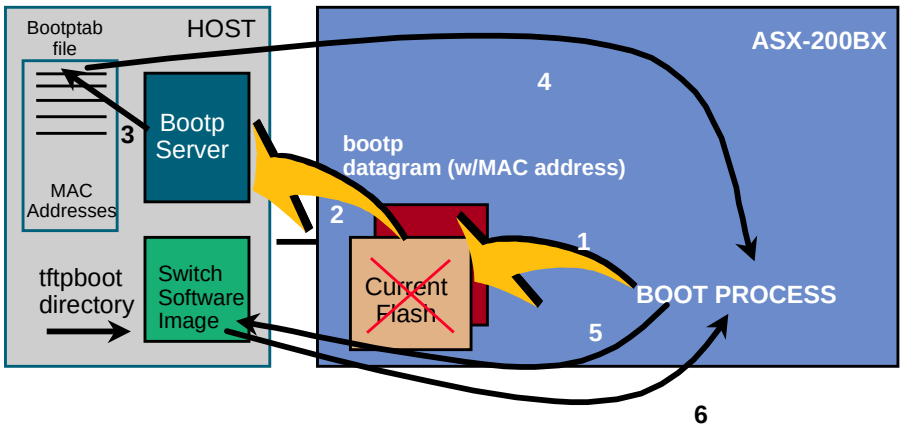
The slide above shows that in a normal boot process, the operating system pointed to in Current is used to boot up the system.

Abnormal boot operation



Core Switch

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1. In an abnormal boot situation, the SCP cannot boot from FLASH memory (the Current operating system software in FLASH being pointed to is corrupted or the FLASH has been recently initialized).

2. The switch attempts to locate a bootp server by broadcasting its MAC address in a bootp datagram across its Ethernet interface.

3. Bootp servers on the Ethernet network look up that MAC address in their bootptab file.

4. If they find the MAC address for the switch, they broadcast a reply that contains a pointer to the switch software image file residing in the tftpboot directory on the bootp server.

5. The SCP then initiates a tftp session with the bootp server using the path and filename in the datagram from the bootp server.

6. The switch software image is then sent to the SCP.

NOTE:

In order for this process to work you must

- Set up an Ethernet connected host as a bootp server
- Add your switch MAC address to the bootptab file
- Set up a tftpboot directory containing the software image on your tftp capable bootp server

Checking/changing the software version

- To check what software versions are currently loaded type
  - operation flash dir
- To check what software version is currently running type
  - operation version
- To change to a different software version type
  - operation version <new version>
- You must reboot the switch to load this new version
  - operation reboot

Core Switch

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When switching versions of software it is important to note the Switch Configuration Database (CDB) may not be compatible with the version of software you are installing (i.e., LANE configuration may not be supported on releases earlier than *ForeThought* 4.0).

Always backup your CDB before upgrading (or downgrading) the switch OS.

SCP Diagnostics from AMI

```
myswitch::operation environment>cpu
CPU  Type    CpuStep  State    DRAMSize  FlashSize  BoardRev  PromRev
1X   i960ha      1    normal   16777216  4194304    D         1.1
1Y   i960ha      1    standby  16777216  4194304    D         1.1

myswitch::operation environment>cpu
CPU  Type    CpuStep  State    DRAMSize  FlashSize  BoardRev  PromRev
1X   p55        68    fail     67108864  8388608    A         1.0
1Y   p55        68    normal   67108864  8388608    A         1.0
```

Core Switch

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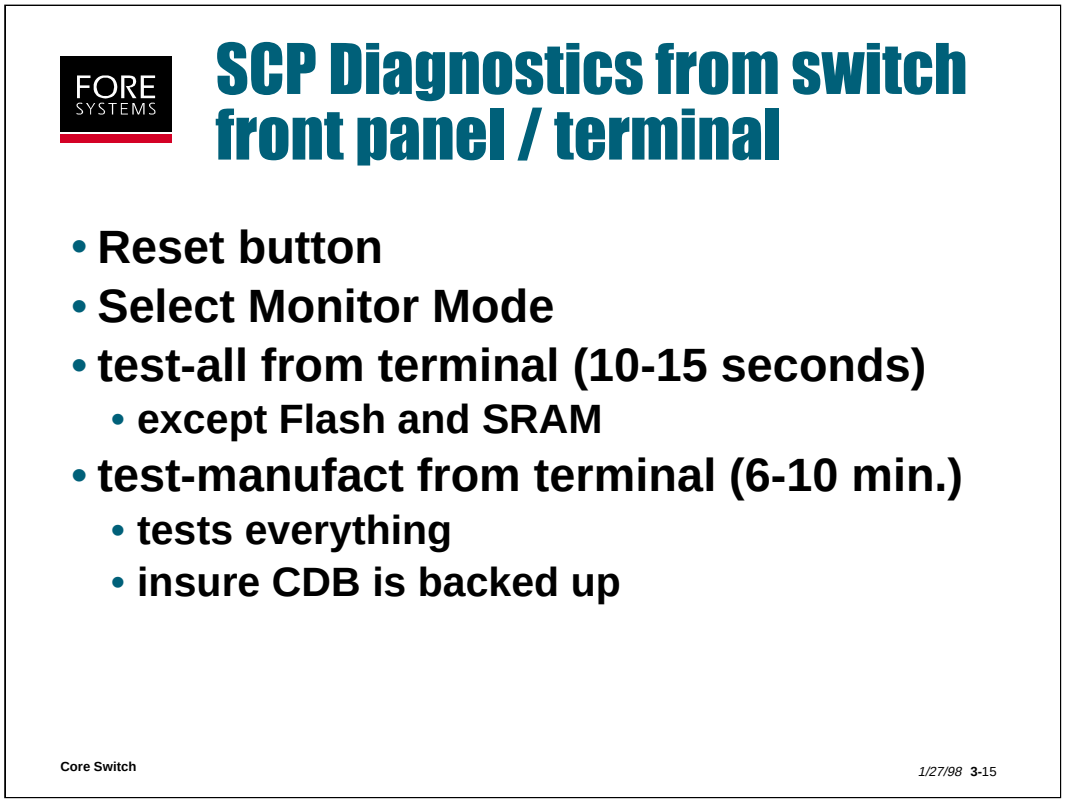
The first step in diagnosing an SCP problem is verifying its parameters as shown above. The CPU column shows which fabric (1-4) and SCP slot (X = left or top / Y = right or bottom) each SCP resides in. The State column will reflect “normal” or “standby” for properly functioning primary or secondary SCPs and “fail” if something is wrong with that SCP. The DRAMSize and FlashSize columns should reflect the appropriate size for that type SCP as follows:

ASX-200WG/25	i960ha	4M Flash / 16M RAM (single only)
LE 155	i960cf	3M Flash / 16M RAM (not swappable)
ASX-200BX & ASX-1000 (standard)	i960ha	4M Flash / 16M
ASX-200BX & ASX-1000 (optional)	i960ha / Pentium	4M Flash / 32M RAM (i960ha) 8M Flash / 64M RAM (Pentium)
TNX-210, TNX-1100 & MSC-900 (standard)	i960ha	4M Flash / 32M RAM (TNX comes with two, MSC with one)
TNX-210 & TNX-1100 (optional)	Pentium	8M Flash / 64M RAM



Running switch diagnostics on FORE ATM switches is performed through the use of the RESET, SELECT and NEXT buttons on the front of the Switch Control Processor. You will also need to have a terminal connected to the serial port of the switch to perform the tests. Refer to Chapter 4 of the *ForeRunner* ATM Switch Diagnostics and Troubleshooting Manual for instructions on performing this operation. Prior to running SCP diagnostics, it is a good idea to backup your CDB, as some of the tests involve temporarily storing Flash contents in a volatile area while performing Flash memory tests.

To access the Monitor mode (to enable SCP diagnostics) first press the **Reset** button with a straightened paper clip. Then press and hold the **Select** button on the front panel. The front panel display will cycle through various tests and because you are holding the Select button it will stop at “TEST BUS”. The next section of the SCP to be tested is the Flash memory, so when you release the Select button “Flash?” will be displayed. Press the **Next** button twice quickly to move to the “Monitor?” display and then press the **Select** button. The terminal will be displaying “SCP Debug Monitor” at this point, and when you press <**ENTER**> the terminal will return a => prompt.

Type **?** and press <**ENTER**> to see a complete list of available Monitor commands.

To test every thing related to the SCP except Flash and SRAM memory type “**test-all**” and press <**ENTER**>. This test should take 10-15 seconds and as it is running the terminal will display OK results to various tests.

To test everything related to the SCP including Flash and SRAM memory, type “**test-manufact**” and press <**ENTER**>. This test will take 6-10 minutes and writes various bit patterns to Flash memory. Because your CDB is stored in volatile memory during this test, a power outage during the test would destroy your CDB. Because of this, it is recommended to perform a CDB backup prior to running this level of diagnostics.

Netmod Resetting

```
myswitch::configuration port>admin <port> ( up | down )

myswitch::configuration module>admin 2B down
Disabling the network module will destroy all existing connections
going through it.
Disable the network module (n)? y

myswitch::configuration module>reset 3b
Resetting the network module will destroy the
existing connections temporarily.
Reset the network module (n)? y
```


If one port (or all ports) on a particular network module do not appear to be functioning correctly, you may “admin” that port or the entire netmod down for testing purposes as shown above and on the next slide.

You may also “reset” the netmod (all connections on this network module will be torn down and rebuilt as appropriate as a result of this command). Depending on the number and type of connections involved, it may take a few seconds. Resetting is similar in effect to removing and replacing with power applied.

Testing Series D Netmods

```
myswitch::configuration module>admin 3A down
Disabling the network module will destroy all existing connections on the
module.
Disable the network module [n]? y

myswitch::operation module >test 3A
Testing a network module may take 5-10 minutes
Start the test?  [n]? y
Press the ENTER key to abort the test!!
Testing SRAM Bank 0……
Testing SRAM Bank 1……
DRAM……
……
……
……
Network module tests successful

myswitch::configuration module>admin 3A up
```

Core Switch

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Series D netmods may be tested using the “operation module test” command.

You should first “admin” the netmod down as discussed previously and shown above.

The tests take 5-10 minutes to complete. If you want to abort the tests before completion, just press <ENTER> during the tests. You will receive the message:

Do you want to abort the tests (n) ?

You may type “y” to abort, or “n” (or <ENTER>) to continue with the tests.

Remember to admin the netmod up after the test is completed.

Switch Environment Troubleshooting

```
myswitch::operation environment>power

PowerSupply   Type              InputState   OutputState
1             psAutoRangerAC    normal       normal
2             psAutoRangerAC    normal       fail
or

PowerSupply   Type              InputState   OutputState   S/N   Version
1             psRM1000HA        normal       normal        12    1
2             psRM1000HA        normal       fail          22    1
or

PS  Type      InputState   OutputState   5VoltState   Current   S/N   Version
1   ps30ADC   normal       normal        normal       normal    10    1
2   ps30ADC   normal       fail          fail         normal    11    1

myswitch::operation environment>temperature

TemperatureSensor      SensorState
enclosure              normal
power-supply-A         normal
power-supply-B         normal
```

Core Switch

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FORE ATM switches provide status information about their power supply voltage and temperature through “AMI operation environment” commands.

Shown above are power supply status for ASX-200BX/TNX-210 at the top, AC power supply status for MSC-900/ASX-1000/TNX-1100 below that and DC power supply status for MSC-900/ASX-1000/ TNX-1100 below that.

The “operation environment power” command shows what type of power supply is in each power supply slot (1 = left for 200/210 or 900/1000/1100 DC or top for 900/1000/1100 AC or the one and only power supply for a WG/25 or LE155), and the input and output voltage state.

The “operation environment temperature” command shows the state of temperature sensors in that particular switch’s power supplies and hardware enclosure.

The MSC-900/ASX-1000/TNX-1100 also provides individual fabric threshold setting and alarms as shown on the next slide.

Switch Fabric Environment Troubleshooting

```
myswitch::operation environment fabric>temperature 50 55

myswitch::operation environment fabric>show

Fabric          Deg C           State
1               31              normal
2               56              overTemp
Alarm/trap reset threshold (this fabric) : 50 degrees C or lower
Alarm/trap trip threshold (this fabric) : 55 degrees C or greater

myswitch::operation environment>fans

FanBank                 FanBankState
1                       normal
2                       failed
3                       normal
4                       normal
```


The MSC-900, ASX-1000 and TNX-1100 add two additional “operation environment” AMI commands to allow threshold setting of the temperature at which a fabric over temperature alarm is turned on, and the temperature at which the alarm is reset, and the capability of determining a failed fan in the fan tray.

ForeView Alarm Configuration and Troubleshooting

- **Look at the icons that represent the power supplies, temperature, fan tray status, and link status. Click on any of the alarm icons at the top of the Front Panel view to launch the alarm configuration dialogue box**

Core Switch

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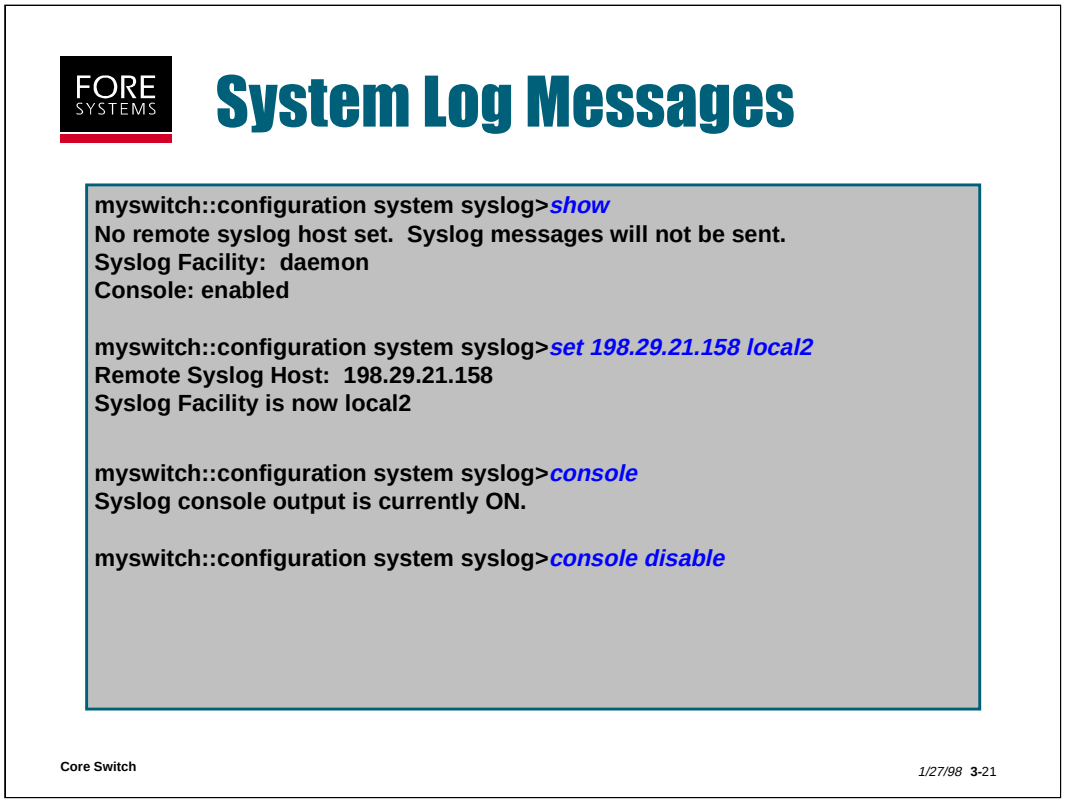
Every *ForeRunner* switch can have user-defined alarms for input and output power supply status, ambient temperature of the board, signaling status and link status. The user can define whether failure is a Major or Minor alarm through the use of the Alarm Control dialogue box.



All FORE ATM switches create system log messages as they operate and send these messages to the console and to a remote host-based syslog if configured.

To determine the current state of system log messages type the AMI command "**configuration system syslog show**" as shown above.

If you want to set up a remote host-based system log facility, type the AMI command "**configuration system syslog set** <**remote host IP address**> **local**x (x = 0-7). This means that you may collect up to 8 switches worth of syslog info on one host. The use of this information for diagnosing a panic condition is discussed on a later slide.

If you want to disable the syslog output to the console port type the AMI command "**configuration system syslog console disable**". This is sometimes handy when you are trying to configure something and are constantly being interrupted by syslog messages.

Syslog Audit Commands

```
myswitch::configuration system syslog audit>?
        show            ami             snmp            ilmi

myswitch::configuration system syslog audit>show
        Facility        Priority
        ami             info
        snmp            notice
        ilmi            off

myswitch::configuration system syslog audit>ami ?
usage: [ emerg | alert | crit | err | warning | notice | info | debug | off ]



DEC 28 12:36:40 london AMI :: ami :: the serial port :: units cps :: Pending

DEC 28 12:36:40 london AMI :: ami :: the serial port :: units cps :: Success
```


The “configuration system syslog audit” command allows you to configure what type of actions trigger a system log entry to be generated and control the priority level assignment of those entries.

Three types of activities (AMI, SNMP and ILMI) can be configured to elicit a syslog entry. If configured, an entry (of the priority level assigned) will be generated each time you issue an AMI command, issue a remote AMI or *Foreview* command or elicit the use of ILMI.

Each of these three may be configured to generate entries at a selected priority level as shown above with AMI. The priority is highest on the left (emerg) and lowest on the right (off). The “audit show” command can be used to display one or all of the facility’s current priority level.

At the bottom of the slide shown above is an example of a syslog output for AMI. Notice that it tells you the date and time of the activity, the switch name it was performed on, the user login, the address that was used to reach the SCP (in this case a direct connection to the serial port), the command and the result of the command.

For more detail of the audit command, refer to the AMI Configuration Commands Reference Manual.

Panic Condition

```
myswitch::operation panic>show
name:tWdTickle status:0x00000004 pri:0
edi:0000000000 esi:0x03e37e10 ebp:0x03e37dd0 esp:0x03e37dcc…
...
…
Software version:  5.1.0 rev 1.16721 with 0 deltas
The panic dump is complete.

or

There is no panic dump to show  you.

myswitch::operation panic>clear
OK
```

Core Switch

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If a FORE ATM switch ever reboots without provocation or hangs up in a particular inoperable state requiring a reboot, a panic file is generated automatically and sent to the syslog host (if one has been designated as on an earlier slide).

Fore's TAC should be contacted with regard to this situation, and if no syslog host was designated, TAC will request that you perform the AMI command "**operation panic show**" to view (and potentially copy) the panic file associated with this switch problem. Panic files are stored in Flash memory, or as part of syslog and may be directed to a remote host.

Once the file has been viewed and copied, TAC will instruct you to perform the AMI command "**operation panic clear**" to clear the panic acknowledgment flag and resume normal operation.

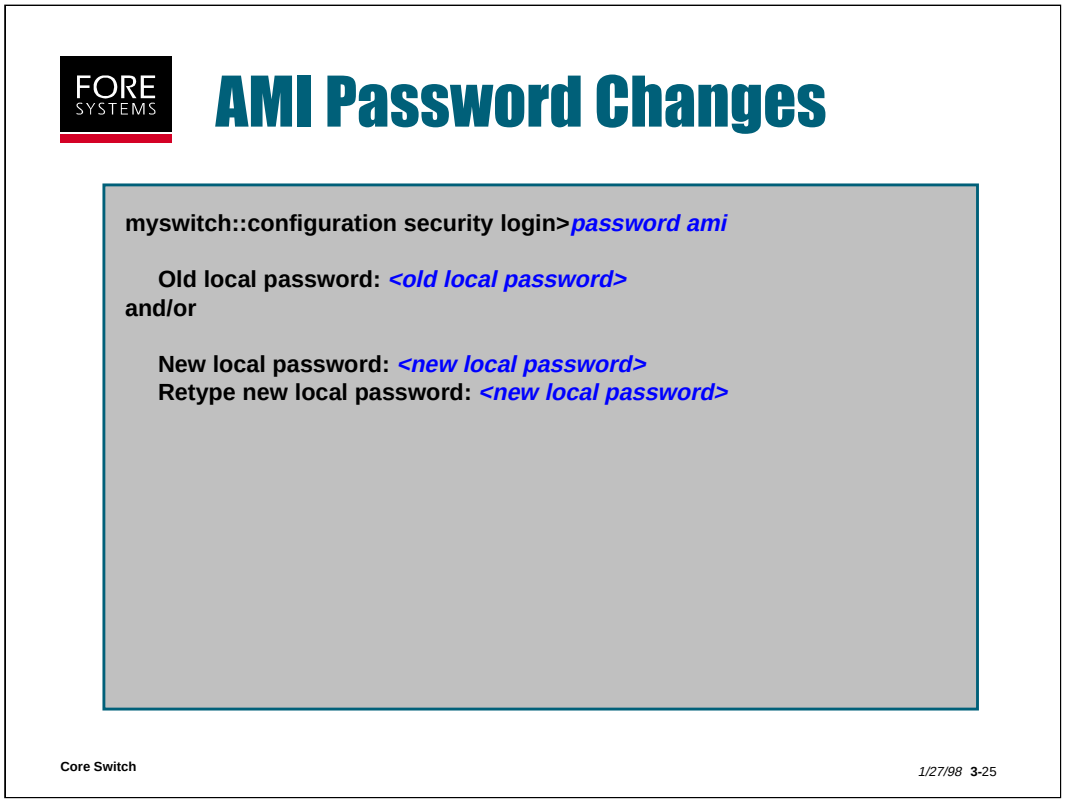
Debug Commands

```
myswitch::debug>?
        dump>           mode            trace>

myswitch::debug>mode
debug mode is set to novice

myswitch::debug dump>cdb size
                        ***** WARNING *****
Debug commands nay have negative effects on the switch software.
Dump commands pause the switch control software for their duration,
may have many pages of output, and cannot be stopped mid-execution.
Various trace commands can overload the switch with syslog messages.
You can turn off this warning with: “debug mode wizard”
Execute the debug command [n]? y

CDB size = 7998 bytes
```


The “debug” commands are normally used after a problem has been encountered on a switch.

The “mode” can be set to novice or wizard, and the difference is mainly in the amount of dialog presented to you when running the commands (an example of the novice script is shown above). In wizard mode the command would have been executed without the warning.

Besides “mode”, the other two debug options are “dump” and “trace”. “Trace” is utilized to turn on or off collection of information and “dump” is used to display the information collected.



The AMI user account password is assigned just like any other user account password (using the “configuration security login password” command). This command has to be performed from an “admin” privilege level user account connected directly or via telnet directly (not through another switch).

If you ever have to remove a password from the AMI user account that you don’t know on an ASX, MSC or TNX switch, perform the following steps:

With a terminal attached to the serial port, reset the switch using a straightened paper clip. When “Decomp…“ displays on the front panel display, press and hold both the **Next** and the **Select** buttons. After a short time the display should stop scrolling. When you release the buttons, the prompt “Boot without reading flash? (y/n)” should be displayed on your terminal. Type “**y**” and press <**ENTER**>. The prompt “Clear the AMI password?” (y/n) will be displayed. Type “**y**” and press <**ENTER**>. The AMI user account on the switch now has no password, just as it is when delivered from the factory. None of the other user accounts are affected by this procedure.

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Switch Maintenance Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. An administrator can determine the ForeThought O/S versions stored in flash memory and the current O/S running by typing the AMI command: "operation flash dir" True / False

2. When the AMI command "operation environment power" is issued, power supply #2 indicates a "fail" condition under Input State and Output State. This condition can be caused by:

   a. no power cord attached to power supply #2
   b. power supply #2 is switched off
   c. power supply #2 has failed
   d. both a and b
   e. a, b and c

3. List 4 components of an ASX1000 switch that are hot swappable**.**

_____ _____

_____ _____

4**.** Which of the following AMI commands will set a FORE switch to its factory default settings?

   a. operation cdb reset
   b. operation cdb restore
   c. operation cdb init
   d. operation cdb manufact

5**.** To delete the current version of switch O/S software the administrator should delete the file in flash called CURRENT. True / False

Switch Maintenance (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. An administrator can determine the ForeThought O/S versions stored in flash memory and the current O/S running by typing the AMI command: "operation flash dir" True / **False**

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   a. no power cord attached to power supply #2

   b. power supply #2 is switched off

   c. power supply #2 has failed

   d. both a and b

   e. **a, b and c**

3. List 4 components of an ASX1000 switch that are hot swappable**.**

fabrics **power supplies**

netmods **fan trays**

4. Which of the following AMI commands will set a FORE switch to its factory default settings?

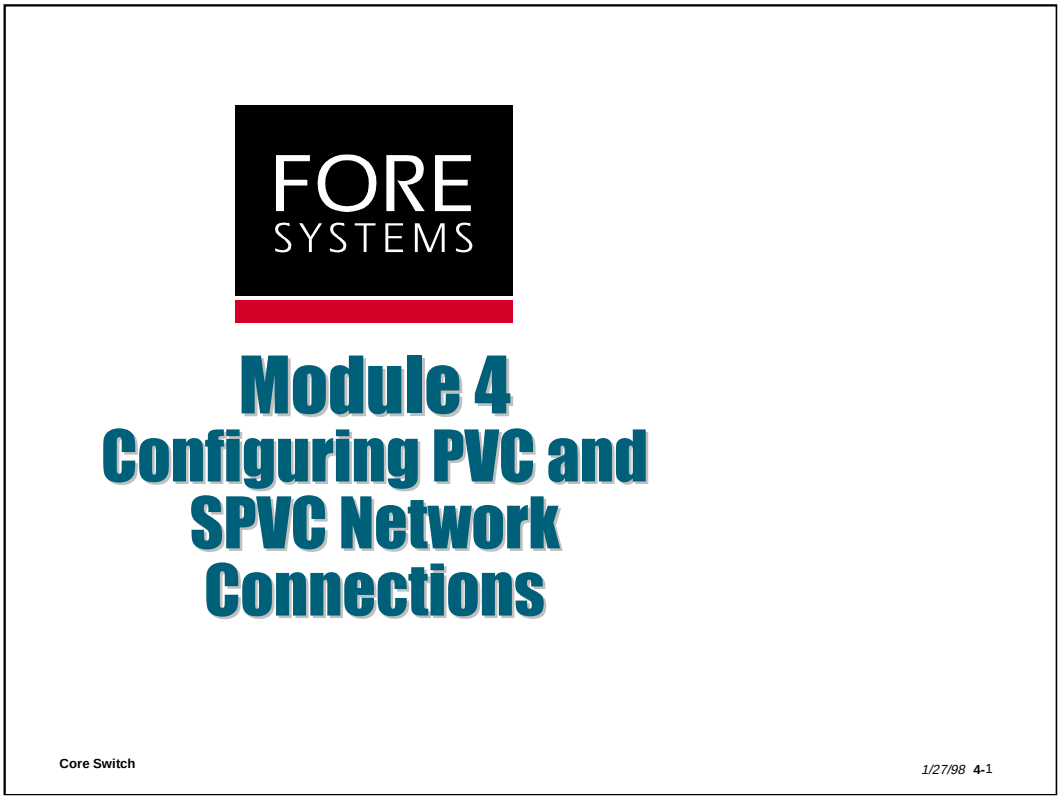
   a. operation cdb reset

   b. operation cdb restore

   c. **operation cdb init**

   d. operation cdb manufact

5. To delete the current version of switch O/S software the administrator should delete the file in flash called CURRENT. True / **False**


FORE
SYSTEMS
Module 4
Configuring PVC and
SPVC Network
Connections
Core Switch
1/27/98 4-1

Creating Network Connections

- **ATM Network Connections between end devices are necessary to pass information.**
- **Connections can be set up manually by a system administrator (PVCs) or dynamically from an end-user through each ATM network component's support of either proprietary or standards-based signaling (SVCs).**
- **Connections may also be made using a combination of these processes and are called SPVCs.**
- **The following slides cover PVCs and SPVCs and the next module covers SVCs.**

Core Switch

1/27/98 **4-2**

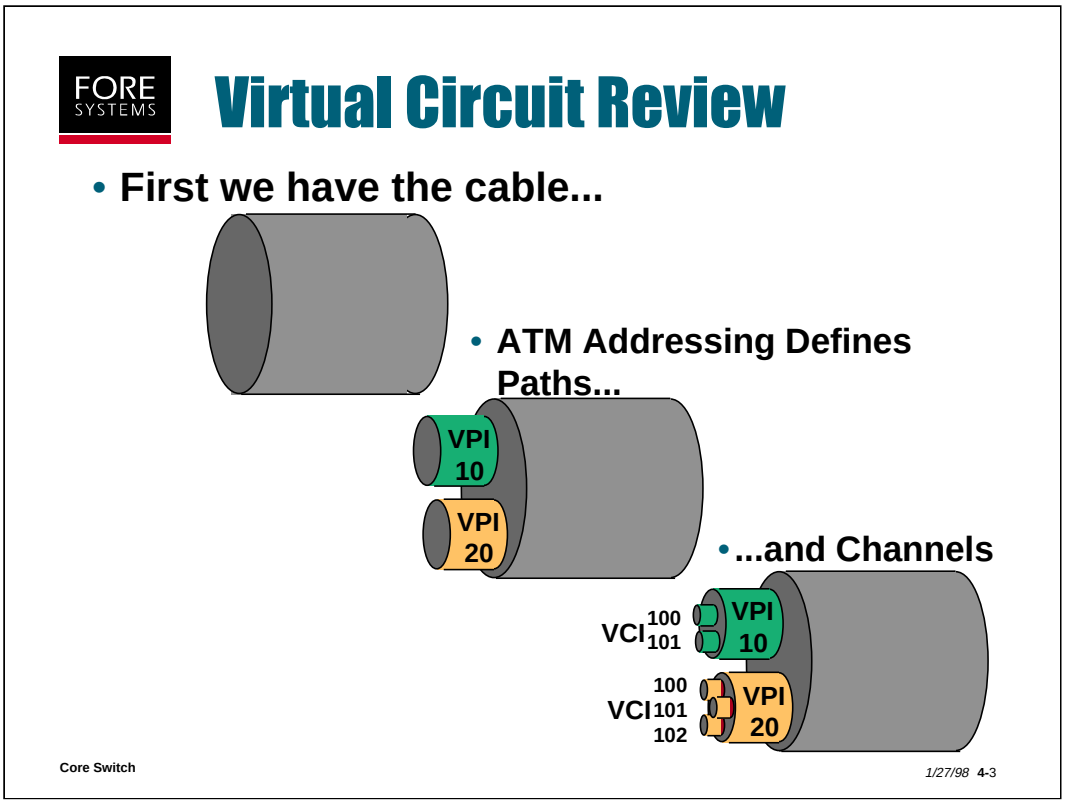
As discussed previously, ATM is a connection-oriented technology, requiring connections to be established prior to any information passing.

These connections can be created by some centrally located system administrator who has complete knowledge of network resources and end user needs. If this method is used, the connections are generally left in place for some time and are called Permanent Virtual Circuits (PVCs).

If an end user is able to "signal" his desire to communicate with another end user, and if all devices in the ATM network can support this request and build a connection, this is called signaling and the result is an SVC or Switched Virtual Circuit. The signaling messages and methods used may be from one vendor (proprietary) or adhere to a published set of standards.

If an end user has end-to-end management capability of the network, he could build PVC like connections at both ends of the network and let the network switches build a connection between themselves using signaling. This combination is called a Smart Permanent Virtual Circuit or SPVC.

This module presents the steps necessary to configure PVC and SPVC connections.



Setting up virtual circuits means that the user creates “spaces” within the media to carry the data. A good analogy is creating a paved highway and then drawing lines to segregate the traffic into specific lanes. These are like “paths” within the media.

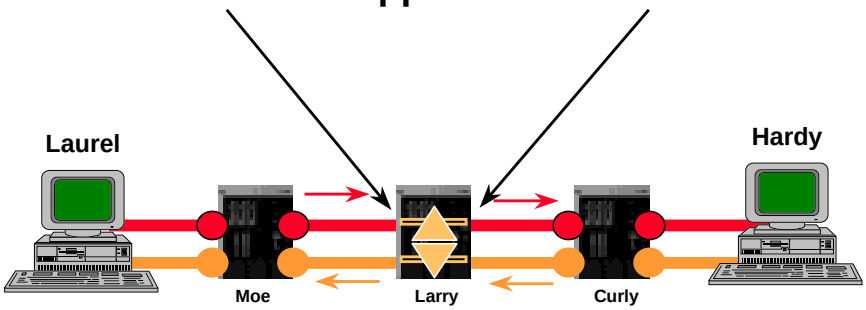
Similarly, some superhighways have special lanes within lanes for different types of vehicles (for example, high occupancy lanes). These “lanes within lanes” are similar to constructing “channels” within a path.

Remember that no channel can be created without first having a defined path.

Each ATM cell has a potentially unique Path and Channel identification number. This number defines a unique channel within a unique path within a unique physical cable attached to an ATM device port. An ATM switch looks at that path and/or channel number on a specific port and maps it to a potentially equally unique path and/or channel number on a different port. This process enables switching. Devices which conduct the full path and channel mapping are called Virtual Path Terminators (VPTs). Some switches only map path to path without regard to channel number and these Virtual Path Connections (VPCs) are called through paths.

PVC Through Path (VPC) Usage

- "Through paths" allow cells to pass through a switch without being fully processed (no channel mapping).
  - Port/Path mapped to Port/Path



Core Switch

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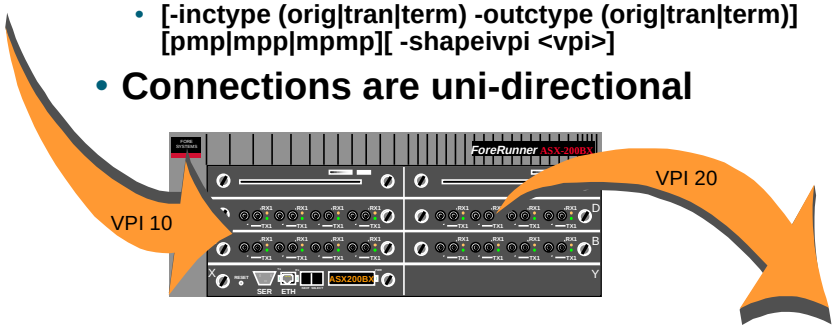
PVC Through paths (VPCs) route an entire virtual path, which may consist of one or more virtual channels through an ATM switch. When a cell is received by a switch on a through path, the VPI is examined to determine the cell's output port and VPI. The VPI value may change, but the VCI remains the same.

In this example, switch Larry will "hand off" the cells that it receives from Moe to Curly. The next slide elaborates on this concept.

Creating a Through Path (VPC) - AMI

- Through paths switch on VPI only.
  - Creating a through path:
    - conf vpc new <iport> <ivpi> <oport> <ovpi> [-upc <index>] [-name <name>]
    - [-inctype (orig|tran|term) -outctype (orig|tran|term)] [pmp|mpp|mpmp][-shapeivpi <vpi>]
  - Connections are uni-directional



In Port	In Path	Out Port	Out Path
1A1	10	1B2	20

Core Switch

1/27/98 4-5

The required parameters for creating a Through Path (VPC) are:

iport - the port number where the through path enters the switch. Always associated to the receive side of the physical port.

ivpi - the virtual path identifier at the input point of the switch. Always related to the Input Port.

oport - the port number where the through path leaves the switch. Always associated with the transmit side of the physical port.

ovpi - the virtual path identifier at the output point of the switch. Always related to the output port.

The optional parameters for a through path are:

[-upc <index>] - the UPC index or contract to be applied to this through path. If no index is given, the switch assumes the default index of 0, which is a UBR contract.

[-name <name>] - a name may be assigned (up to 32 ASCII characters) to this particular path which may be useful for billing purposes.

[-inctype (orig|tran|term) - indicates the connection type for the incoming path.

[-outctype (orig|tran|term) - indicates the connection type for the outgoing path.

[pmp|mpp|mpmp] - indicates the type of path for billing purposes.

[-shapeivpi <vpi>] - this parameter is specified when through paths are used to "shape" traffic coming from a port connected to a WAN.

On an ASX-1000 you may go through the "E" fabric to enable building a VPC from a port on one fabric to a port on another fabric (saving ports in the process).

Creating a Through Path (VPC) - AMI Example

```
myswitch::configuration>vpc ?
delete                  new                  show

myswitch::configuration vpc> new 1a1 10 1b2 20 -name fore
-inctype tran -outctype tran

myswitch::configuration vpc> show 1a1

Input      Output
Port VPI   Port  VPI   UPC    Prot      Name
1A1  10    1B2    20     0     pvc       fore

myswitch::configuration vpc> show 1a1 advanced

 Inport       Output
 Port  VPI    Port VPI    Shape   ConType
 1A1    10    1B2   20              tran-tran-pp
```

Core Switch

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This slide illustrates an example of the actual command string entered through AMI to create a VPC through path and then shows the normal and advanced versions of the “conf vpc show” AMI command for a particular port.

The information shown in this display can be interpreted as follows:

Input Port/VPI - the actual port number this path arrives at.

Output Port/VPI - the actual port number this path leaves from.

UPC - the UPC index (contract) number applied to this path.

Prot - the protocol used to create this path (PVC).

Name - the name of this particular path that was assigned.

Shape - Indication of whether shaping has been enabled for this path.

ConType - Indicates the endpoint connection types for the ingress-egress and path type label assigned to this path.

Orig = originating node

Term = terminating node

Tran = Transit node

pp = point to point (default)

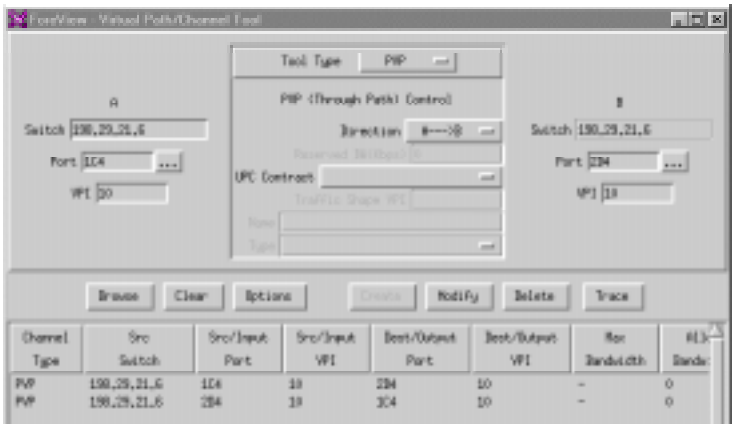
pmp = Point to multipoint

mpp = mutipoint to point

mpmp = multipoint to multipoint

Creating a Through Path (VPC) - *ForeView*

- **Users can create Through Paths via the PVP tool. PVPs only need port and path info since Through Paths only switch on VPIs.**



Core Switch

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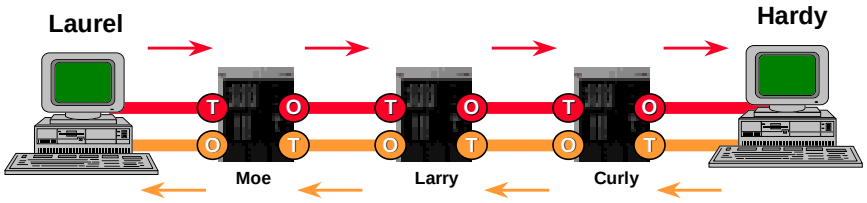
To configure virtual paths or channels with *ForeView*, you use the Channel Tool. This tool can be chosen from the FVMap icons or from the Front Panel display menu bar (VPC/VCC Control).

To configure a through path, select PVP. When the screen above appears, fill in the port and path info that you require and select Create.

On ASX-1000s you can configure end points on different fabrics (unlike AMI commands where multiple commands utilizing the “E” fabric are required).

PVC Virtual Path Terminator (VPT) Usage

- **Virtual Path Terminators are either**
  - **Originating Path**
  - **Terminating Path**
- **Reference the Viewpoint of the Switch**
- **Connections are *unidirectional***
- **VPTs may be created, deleted or modified**



Core Switch

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Originating VPT paths are those which “originate” or begin at the switch.

Terminating VPT paths are those which “terminate” or end at the switch.

It is important to note that these paths are unidirectional.

When setting up connections, the user must remember that “originating” and “terminating” are from the switch perspective.

In the example above:

The host Laurel has established a connection to a port on the first switch Moe where it “terminates”.

Moe originates an inter-switch connection to Larry.

Larry has a terminated connection from Moe and also originates a connection to Curly.

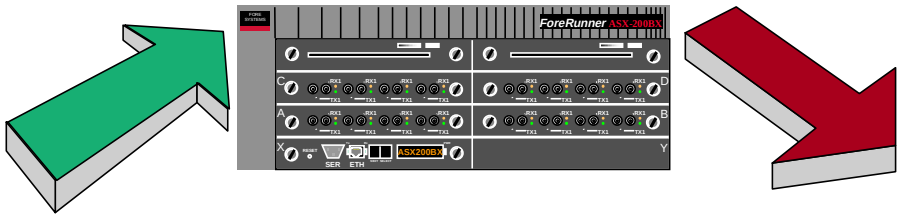
Finally, Curly originates a connection to host Hardy.

Connections are also set up through the switches from Hardy to Laurel in the opposite direction.

Each of these connections can be setup to “ride” on a specific virtual path identifiers (VPI) or virtual channel identifiers (VCI) on a link by link basis.

Creating Terminating and Originating Paths (VPTs) - AMI

- **Creating a Terminating/Originating path:**
  - **conf vpt new <port> <vpi> (term|orig) [-reserved <Kbs>] [-minvci <minvci>] [-maxvci <maxvci>]**
  - **Advanced options: [-shapeovpi <vpi>] [-vbrob <percent>] [-vbrbuffob <percent>]**
- **Modifying a Terminating/Originating path:**
  - **conf vpt modify <port> <vpi> (term|orig) -reserved <Kbps>**



Extended QoS options for both Create and Modify: [-cbr (none | default | <QosExt Index>)][-rtvbr/-nrtvbr/-ubr/-abr (same as cbr)]

Core Switch

1/27/98 **4-9**

The required parameters for a Terminating or Originating path include:

port & vpi - the physical input/output port and input/output virtual path identifier to be created.

term|orig - identifies this path as either a Terminating or Originating Path.

The optional parameters for a Terminating or Originating path include:

-**reserved** - the amount of bandwidth, specified in Kbits/second that should be reserved for this path. This parameter is optional, and if not specified is assumed to be 0, or UBR.

-minvci - the minimum number of Virtual Channels the path should support. This parameter is optional and if not specified is assumed to be 1.

-maxvci - the total number of Virtual Channels the path should support. This parameter is optional and if not specified is assumed to be 511.

The advanced optional parameters for an Originating path include:

-shapeovpi - indicates the output port of a traffic shaping originating path. This parameter is optional and is used only when shaping is required for the originating path.

-vbrob - indicates the percentage of bandwidth overbooking assigned to this path for VBR traffic. Only integer values greater than or equal to 1 are valid. The default is 100, which implies that no overbooking has been defined. Values less than 100 imply underbooking, greater than 100 implies overbooking.

-vbrbuffob - indicates the percentage of buffer overbooking assigned to this path for VBR traffic. Valid values for this parameter are the same as for vbrob.

QoSExt index references may also be assigned on a per VPT per QoS basis.

Creating a Terminating and Originating Path - AMI Example

```
myswitch::configuration vpt> new 1c1 20  term -reserved 10000

Would you like to create the originating side also [y]?

myswitch::configuration vpt> show 1c1

Input        Output
Port  VPI    Port  VPI   ResBW   CurBW   MinVCI  MaxVCs  VCs  Protocol
1C1     0    terminate     N/A    0.8K        1     511    6  pvc
1C1    20    terminate    10.0M   0.8K        1     511    6  pvc
originate    1C1     0     N/A    0.8K        1     511    6  pvc
originate    1C1    20    10.0M   0.8K        1     511    6  pvc

myswitch::configuration vpt> show advanced 1c1

Input        Output
Port  VPI    Port  VPI   Shape   VBROB   BuffOB
1C1     0    terminate     N/A     N/A      N/A
1C1    20    terminate     N/A     N/A      N/A
originate    1C1     0             100      100
originate    1C1    20             100      100
```

Core Switch

1/27/98 4-10

This slide illustrates an example of the actual command string entered through AMI to create a vpt and then shows the normal and advanced versions of the “conf vpt show” AMI command for a particular port.

The information shown in this display can be interpreted as follows:

Input Port/VPI - the actual port number this path arrives at.

Output Port/VPI - the actual port number this path leaves from.

ResBW - the bandwidth reserved for the virtual channels using this vpt.

CurBW - the bandwidth being used by the virtual channels on this vpt.

MinVCI - the lowest VCI number for VCCs using this vpt (default = 1).

MaxVCI - the highest VCI number for VCCs using this vpt (default = 511).

VCs - the number of VCCs currently using this vpt.

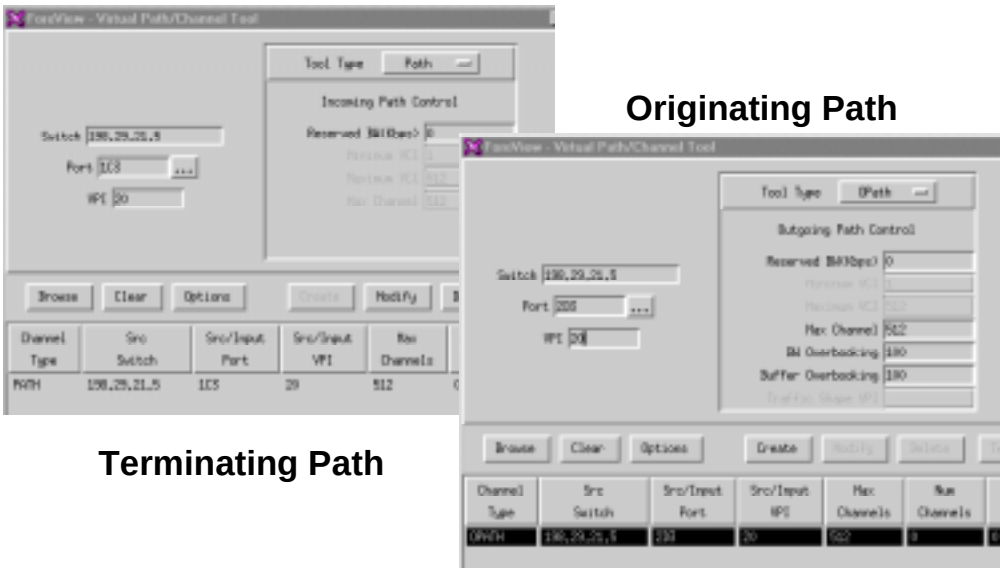
Protocol - the protocol used to create this path (PVC).

Shape - Indication of whether shaping has been enabled for this path.

VBROB - Indicates the bandwidth overbooking level assigned to this vpt (default = 100) for VBR connections.

BuffOB - Indicates the buffer overbooking level assigned to this vpt (default = 100) for VBR connections.

Creating a Terminating and Originating Path - *ForeView*



Core Switch

To configure virtual paths or channels with *ForeView* you use the Channel Tool. this tool can be chosen from the FVMAP icons or from the Front Panel display menu bar (VPC/VCC Control).

To configure a Terminating Path, select “Path” from the pull-down VPC/VCC Control menu. The screen shown on the left above will appear.

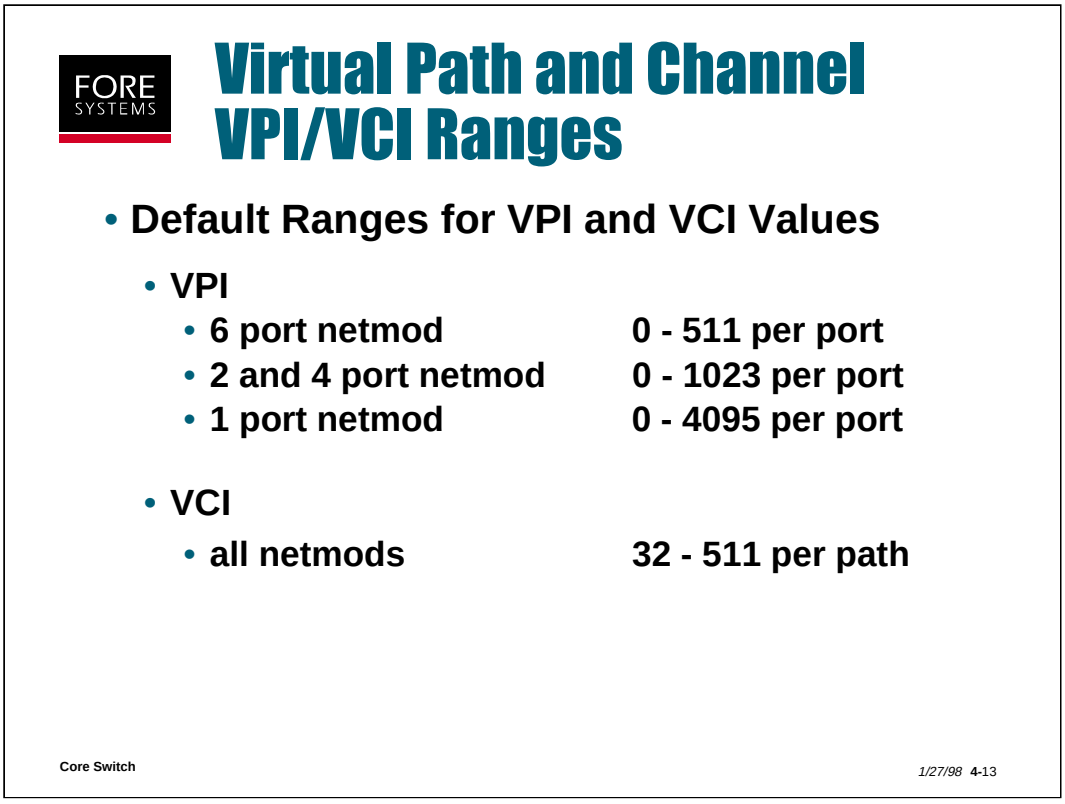
To configure an Originating Path, select “0Path” from the pull-down VPC/VCC Control menu. The screen shown on the right above will appear.

Notice for either, you are only configuring one direction on one path on one port.

Automatic Virtual Path and Channel Configuration

- One PVC Path will be created by the Switch Control Software
  - VPI 0 - Used for Signaling and SVCs
- On Path 0 at every port, four PVC channels will be created automatically
  - VPI 0 - VCI 5 used for UNI signaling
  - VPI 0 - VCI 14 used for FORE's CLS (Connectionless Service)
  - VPI 0 - VCI 15 used for FORE's SPANS (Simple Protocol for ATM Network Signaling)
  - VPI 0 - VCI 16 used for ILMI (Interim Local Management Interface)

Note: The default path and channels may be deleted by the user. A caution here is that if Path 0 is deleted, the underlying channels (5, 14, 15 and 16) will also be deleted. If Path 0 is then re-created by the user, these channels will not be automatically restored. In order to re-create these channels, the user must re-enable SPANS and/or UNI signaling on that path. If any other new path is created the same actions must be taken if signaling is needed on that new path.



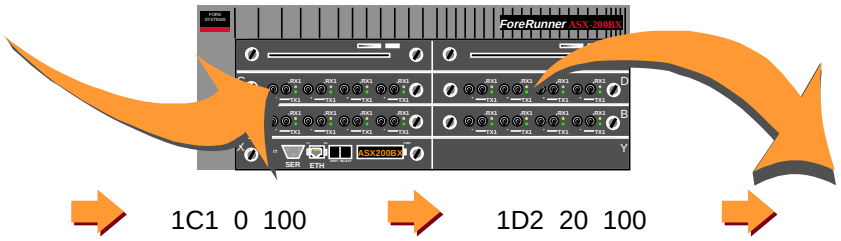
The virtual path identifier (VPI) range is dependent on whether the connection exists in the UNI or NNI of the network (256 for UNI connections and 4,096 for NNI connections). The table above suggests some VPI ranges you can assign to the ports of a network module.

A virtual channel identifier (VCI) can be created within a path. Since VPI 0 is automatically created by the switch control software (SCS), the SPANS, CLS, UNI Signaling, and ILMI channels are created automatically as well (Channels 15, 14, 5 and 16 respectively).

Other channels between 0 and 31 may eventually be reserved for other needs (ATM Forum LAN Emulation 1.0 uses channel 17, ATM Forum PNNI 1.0 uses channel 18, etc.) so, it is suggested that users start their connections at Channel 32 through 511.

Creating PVC Virtual Channel Connections (VCC) - AMI

- VCCs must be created on existing VPTs.
  - VCC Parameters are:
    - conf vcc new <iport> <ivpi> <ivci> <oport> <ovpi> <ovci> [-upc <index>] [-name <name>]
    - [inctype (orig|tran|term) -outctype (orig|tran|term) [pmp|mpp|mpmp]]



Core Switch

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The required parameters for creating a PVC Virtual Channel Connection include:

iport - the port number where the virtual channel enters the switch. Always associated to the receive side of the physical port.

ivpi - the virtual path identifier at the input point of the switch. Always related to the input port.

ivci - the virtual channel identifier at the input point of the switch. Always related to the input port.

oport - the port number where the virtual channel leaves the switch. Always associated with the transmit side of the physical port.

ovpi - the virtual path identifier at the output point of the switch. Always related to the output port.

ovci - the virtual channel identifier at the output point of the switch. Always related to the output port.

The optional parameters for creating a Virtual Channel Connection are:

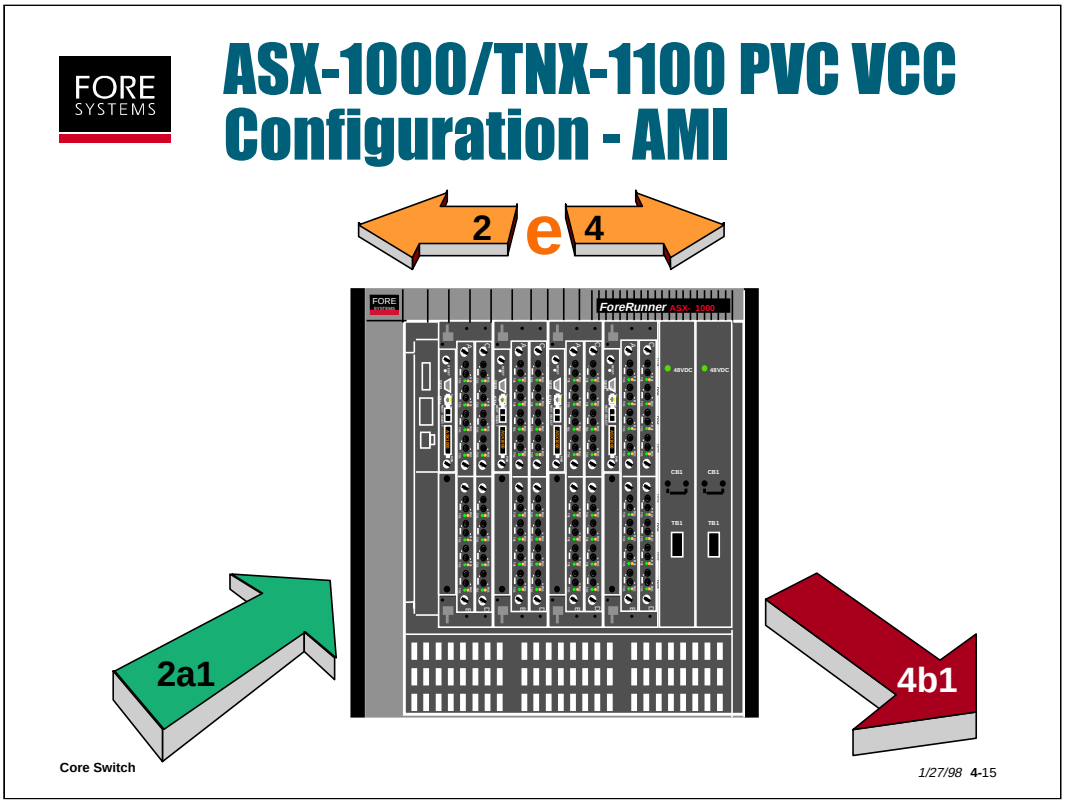
[-upc <index>] - the UPC index or contract to be applied to this Virtual Channel Connection. If no index is given, the switch assumes the default index of 0, which is a UBR contract.

[-name <name>] - a name may be assigned (up to 32 ASCII characters) to this particular VCC which may be useful for billing purposes.

[-inctype (orig|tran|term) - indicates the connection type for the incoming channel.

[-outctype (orig|tran|term) - indicates the connection type for the outgoing channel.

[pmp|mpp|mpmp] - indicates the type of channel for record keeping purposes.



On an ASX-1000 or TNX-1100 if you want to configure a PVC (VCC) from a port on one fabric (fabric 2, port a1 in the example above) to a port on another fabric (fabric 4, port b1 in the example above) you may go through the intra-fabric (e above).

The intra-fabric port 2e4 means that traffic is coming from fabric 2 and going to fabric 4. The intra-fabric port 4e2 means that traffic is coming from fabric 4 and going to fabric 2.

So, the commands in AMI to complete this vcc connection would look as follows:

configuration vcc> new 2a1 0 100 2e4 0 100

configuration vcc> new 2e4 0 100 2a1 0 100

and:

configuration vcc> new 4b1 0 100 4e2 0 100

configuration vcc> new 4e2 0 100 4b1 0 100

PVC Virtual Channel Creation- AMI Example

```
myswitch::configuration>vcc ?
delete                new                   show

myswitch::configuration vcc> new 1c1 0 100 1d2 20 100
myswitch::configuration vcc> show 1c1
Input                 Output
Port  VPI  VCI   Port  VPI  VCI  UPC  Protocol  Name
1C1     0    5   1CTL    0   40    0  uni       N/A
1C1     0   14   1CTL    0   39    0  spans     N/A
1C1     0   15   1CTL    0   38    0  spans     N/A
1C1     0   16   1CTL    0   55    0  uni       N/A
1C1     0  100   1D2    20  100    0  pvc       N/A
```

Core Switch

1/27/98 4-16

This slide illustrates the command used to create a new virtual channel connection. Notice the new channel for this port (1C1) is shown at the bottom of the display list. Notice also that the software sorts the display by the input port number. The remaining information in this display can be interpreted as follows:

Input **Port** - The actual port number this channel comes from

VPI - The path number used for this channel on the input port.

VCI - The channel number at the input port.

Output **Port** - The actual port number this channel is to leave from.

VPI - The path number used for this channel at the output port.

VCI - The channel number at the output port.

UPC - the unique UPC index applied to this channel. Note that if this option is not given, the default is a UPC index 0 or a UBR contract

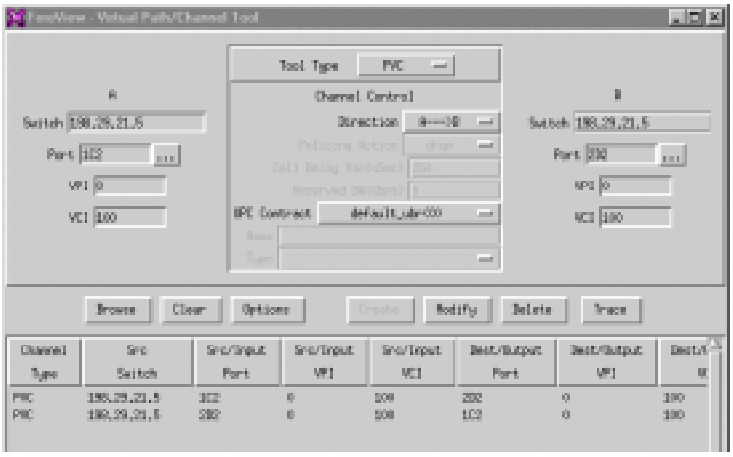
Protocol - the protocol used to create this channel. This field will show PVC for channels that you create using this command.

Name - The name for this channel that you have assigned.

Note that for this specific example, the output path 1D2 20, would have to be created before this channel could be created. Notice also that the four channels shown besides the one created by the user are the default channels created at each port by the switch control software.

PVC Virtual Channel Creation - *ForeView*

- **VCCs are created by selecting the PVC tool and entering the port, path and channel for each end point and clicking on Create.**



Core Switch

To create virtual channel connections using *ForeView*, you use the Channel Tool. This tool can be chosen from the FVMap icons or from the Front Panel display menu bar (VPC/VCC Control).

To configure a virtual channel connection, select PVC. When the screen above appears, fill in the port, path and channel info that you require and select Create.

On ASX-1000 or TNX-1100s you can configure end points on different fabrics (unlike AMI commands where multiple commands utilizing the “E” fabric are required).

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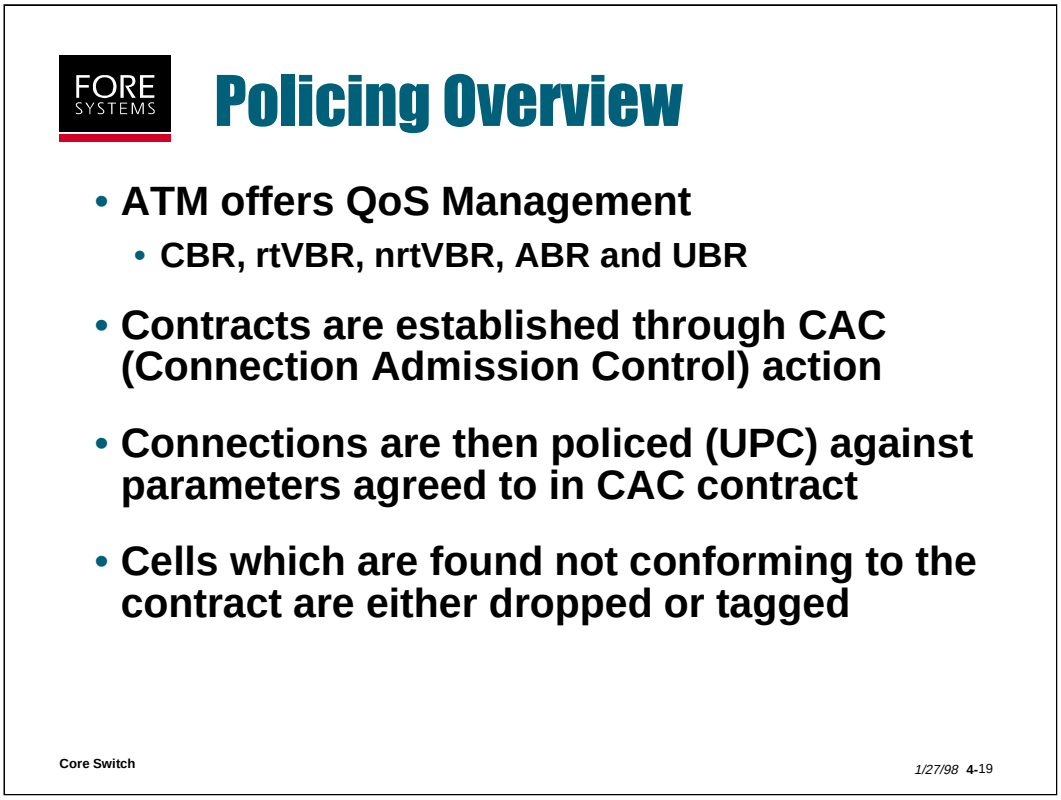


One of ATM's advantages over other technologies is its capability of supporting a unique Quality of Service on a per connection basis. The ATM Forum has established various classes of service to help support ATM's original goal of ubiquitous information handling. These include: Constant Bit Rate (CBR), real time and non-real time Variable Bit Rate (rtVBR/nrtVBR), Available Bit Rate (ABR) and Unspecified Bit Rate (UBR) . Each of these classes of service defines a set parameters which will be used to establish the contract through the Connection Admission Control (CAC) process and then used to police the contract through the User Parameter Control (UPC) process.

As cells are policed, if they are found not to be in conformance with the contract that was established, they are either dropped or tagged (their CLP bit in the cell header changed from 0 to 1).

UPC contracts may be applied in three ways, as part of the original signaling request call setup message (SVC based), as part of VPC, VCC, UNI or SPANS configuration (PVC based) or as part of an SPVC PNNI setup.

The following slides discuss the PVC approach to UPC policing.

Creating UPC Contracts - AMI

```
myswitch::configuration>upc ?
delete                  new                     show

myswitch::conf upc> new <index> ubr [aal5 [noPktDisc]] [ubrTagging] [AltCLP] [-name
<name> ]
or...
myswitch::conf upc> new <index> <UPC> [-cdvt ,us] [noGCRA] [aal5 [noPktDisc] [PPPol]]
[AltCLP] [-scheduling (roundrobin | smoothed | guaranteed)] [-name <name>]
Where UPC is one of the following combinations of traffic parameters:
cbr         <pcr01>
cbr0        <pcr0> <pcr01> [tag]
vbr         <pcr01> <scr01> <mbs01>
vbr0        <pcr01> <scr0> <mbs0> [tag]

myswitch::conf upc>show
Index  PCR01  SCR01  MBS01  PCR0  SCR0  MBS0  CDVT  TAG  Name
0                                                       default_ubr

myswitch::conf upc>show [<index>] [flags]
Index  GCRApol  PPpol  AAL5  PktDisc  UBRtag  AltCLP  Scheduling  Name
0                                                    roundrobin  default_ubr
```

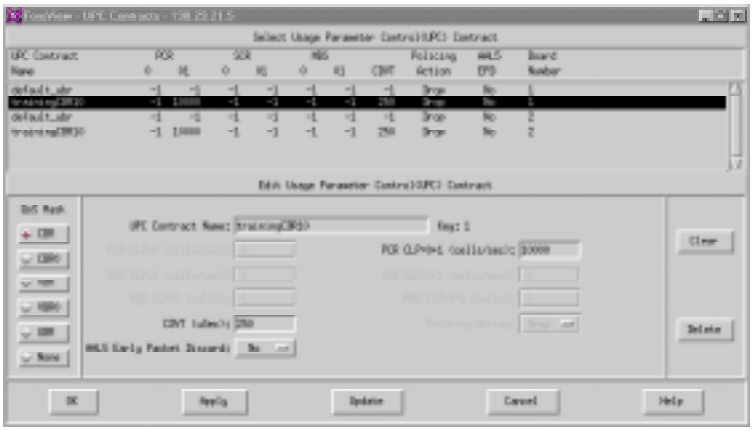

UPC contracts are created using the AMI command “conf upc new”. Until ABR is fully defined and standardized, the contract types that you may create are UBR, CBR with and without tagging and VBR with and without tagging. For each of these you may define many unique parameters, which means that the total number of contract types is virtually unlimited.

Parameters which may be assigned include an index number for that particular contract, the type as shown above and:

pcr01 - peak cell rate for all cells (CBR or VBR)
pcr0 - peak cell rate for CLP=0 cells (tagging may be selected) (CBR or VBR)
scr01 - sustainable cell rate for all cells (VRB only)
scr0 - sustainable cell rate for CLP=0 cells (tagging may be selected) (VBR only)
mbs01 - maximum burst size for all cells (VBR only)
mbs0 - maximum burst size for CLP=0 cells (tagging may be selected) (VBR only)
tag - non-conforming CLP=0 cells are to be tagged
-cdvt us -Cell Delay Variation Tolerance in us for PCRs (CBR or VBR)
noGCRA - disables GCRA policing for CBRs and VBRs
aal5 - indicates connection is using AAL5
noPktDisc - disables EPD/PPD on this connection
ubrTagging - tags all UBR traffic (makes it CLP=1)
PPPol - enables Partial Packet Policing for this connection
AltCLP - for Series D netmods allows use of an alternative CLP threshold
-scheduling - for Series D netmod indicates the output method for traffic flow
-name <name> - assign a unique name for this contract
[flags] - When used with “show” lists the status of all traffic management flags (options)

Creating UPC Contracts - *ForeView*

- **UPC contracts are created by selecting UPC from the Configure pull-down menu (Front Panel display) and filling in needed values.**



Core Switch

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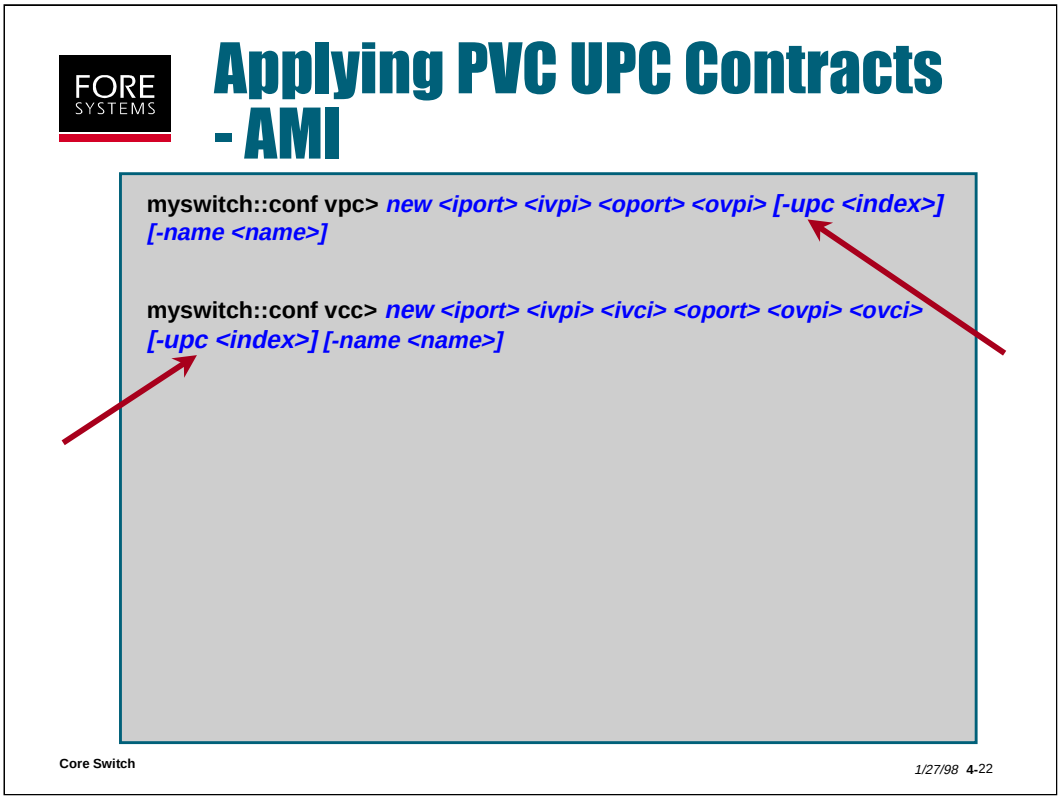
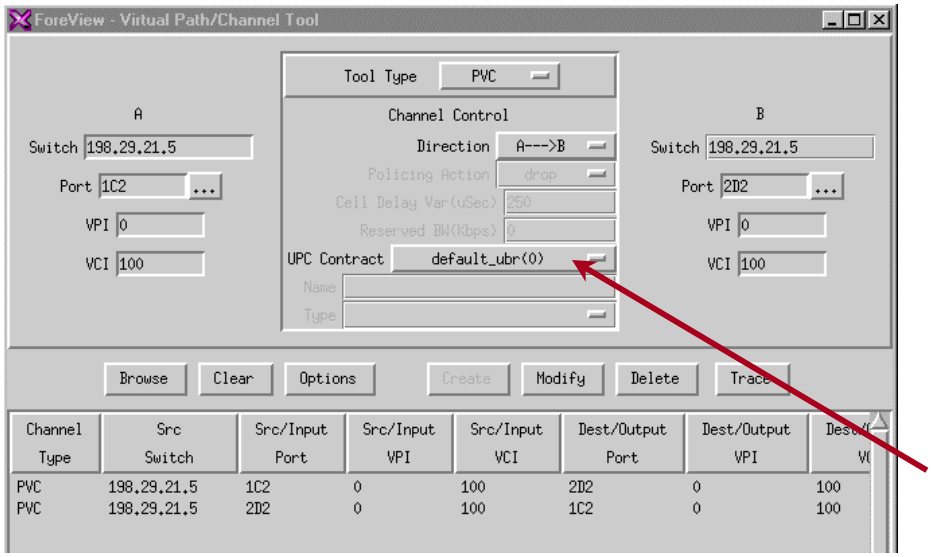
To configure UPC contracts with *ForeView*, use the Front Panel display's menu bar to select Configure and then UPC. The UPC Contract display screen shown above will appear and may be used to create all of your different UPC contracts.



When using AMI to manage the switch, apply your pre-configured UPC contracts by referring to the UPC index number for the particular contract that you want to apply to this connection.

Applying PVC UPC Contracts - *ForeView*



To apply a UPC contract using *ForeView*, select UPC Contract from the PVC or PVP creation screen, select the UPC pre-configured contract of your choice and select Apply

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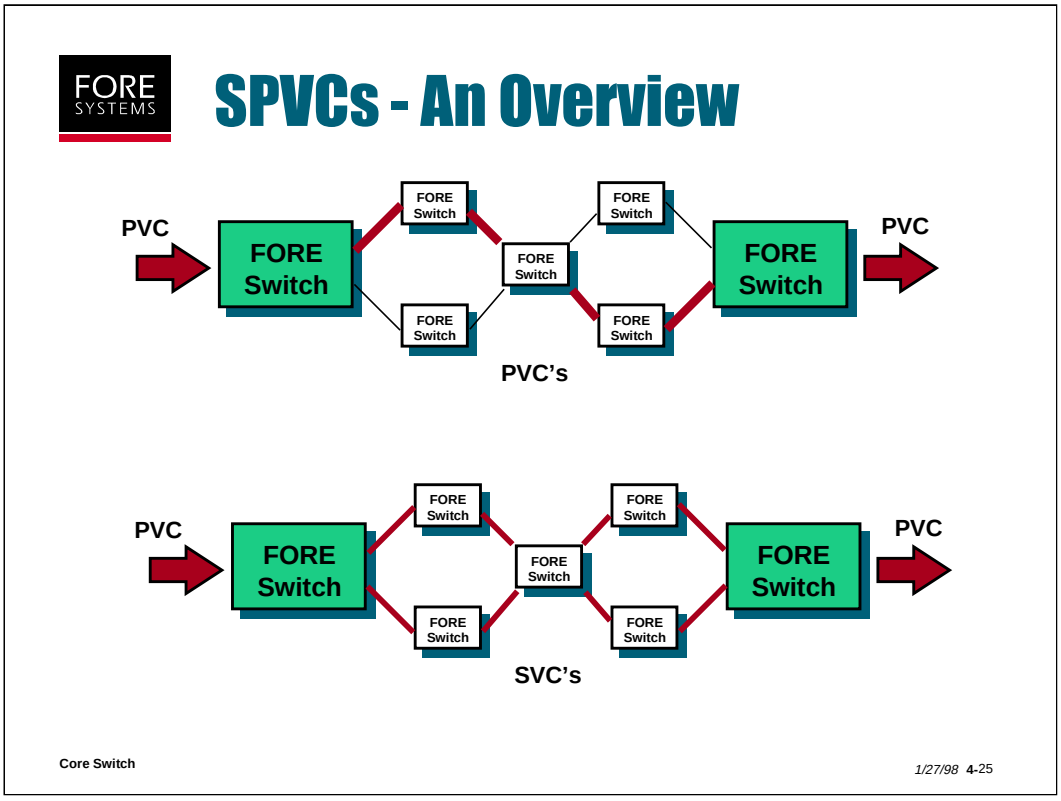

Smart PVCs (SPVCs) were created mainly to overcome a problem inherent with PVCs.

As shown in the top drawing, a PVC is made link by link from switch to switch in a permanent fashion. If any one of the links fails, that PVC is not functional until the system administrator detects the problem and manually creates a new set of links around the problem. This takes time (at least seconds, maybe minutes).

SPVCs on the other hand rely on signaling (SPANS and FT-PNNI/PNNI) to add resilience to all the links between the first switch and the last switch, creating what has been called a PVC cookie (hard on the outside and soft on the inside).

Configuring SPANS SPVCs - AMI

```
myswitch::configuration> spvc ?
spans>          pnni>

myswitch::conf spvc> spans ?
delete              new                 show

myswitch::> open 198.29.22.46 private
198.29.22.46::> localhost

myswitch::conf spvc spans> new  <port> <vpi> <vci> <dest-session> <dest-port>
<dest-vpi> <dest-vci> [-peak <Kbps>] [(source | destination | bidirectional)]

myswitch::conf spvc spans> new 1c1 0 49 198.29.22.46 1b1 0 50

myswitch::conf spvc spans> show
Local                                                  Remote
ID      Port  VPI  VCI   BW   Direction      ID      Port  VPI  VCI   Switch
65364   1C1     0   49   0.0   bidirectional  42591   1B1     0   50   198.29.22.46

myswitch::conf spvc spans> delete 65364
```

Core Switch

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To configure SPANS SPVCs using AMI commands you will use the subcommands under “conf spvc spans”.

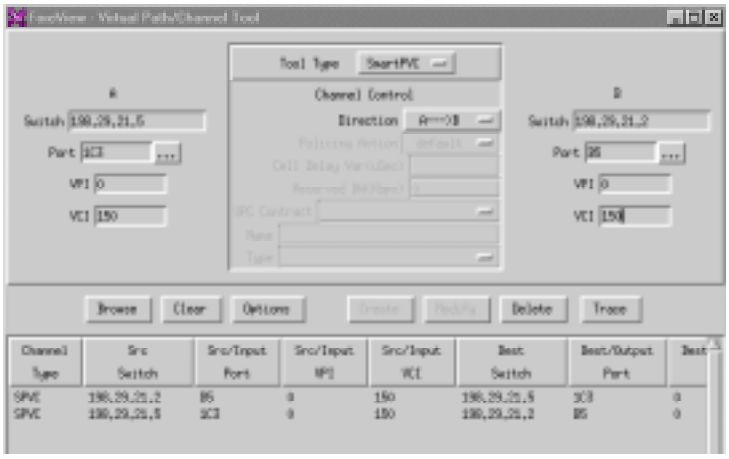
Before creating a SPANS SPVC from your local ami session, you must open a private ami session with the remote switch at the far end of your ATM network.

Then revert to the still open local ami connection and issue the “conf spvc spans new” command as shown in the example above.

To delete a SPANS SPVC, simply delete the local ID number.

Configuring SPANS SPVCs - *ForeView*

- **SPANS SPVCs are created by selecting SmartPVC from the VPC/VCC Control pull-down menu (FP display) and filling in values.**



To configure SPANS SPVCs using *ForeView*, select SPVC from the pull-down VPC/VCC Control menu.

Notice that for SPVCs it is expected that you will be entering port, path and channel information from different switches.

Configuring PNNI SPVCs - AMI

```
myswitch::configuration> spvc ?
spans>              pnni>

myswitch::conf spvc> pnni ?
delete              new             parameters>          show

myswitch::conf spvc pnni> new  <port> <vpi> <vci> <destnsap | destprefix:destport>
[-spvcid <index>] [-domainid <id>] [-name <name>] [-destvpi <vpi> -destvci <vci>]
[-reroute (enable|disable)] [-fupc <index>] [-bupc <index>]
advanced options:
[-ftpnniDtl <index>] [-bearerClass (X|A|C)] [-clip (no|yes)] [-QoSExpIndex <index>]
[-fqos (class0 | class1 | class2 | class3 | class4)] [-bqos (class0 | class1 | class2 | class3 | class4)]

myswitch::conf spvc pnni> new 1a1 0 100 47.0005.80.ffe100.0000.f21b.19cd:1b1

myswitch::conf spvc pnni> parameters ?
pacing>             reroute>

myswitch::conf spvc pnni parameters> pacing ?
interval        number      show

myswitch::conf spvc pnni parameters> reroute ?
interval        number      show            threshold
```

Core Switch

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To configure PNNI SPVCs using AMI commands you will use the subcommands under “conf spvc pnni”.

Notice that there is a subcommand “parameters” which as shown at the bottom of the slide, which includes pacing information and reroute information.

Pacing allows you to indicate a number of SPVCs to be reopened at one time (default is 20/range is 1-1000) after an outage, then a time period to wait before attempting the next number of call setups (default is 2 seconds/range is 1-300 seconds).

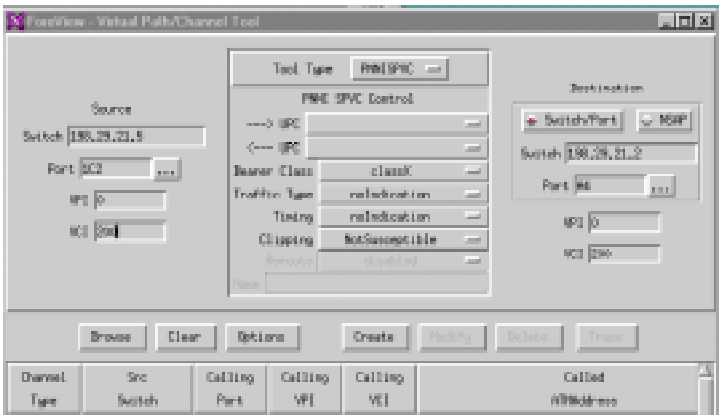
Reroute allows you to indicate a number of SPVCs (default is 20/ range is 1-1000) at one time to have their route costs re-evaluated and re-established if new routes would improve their route costs by a certain threshold (default is 50%/range is 1-99), and then the time period to wait before the next route re-evaluation (default is 10 seconds/range is 1-3600 seconds).

The “conf spvc pnni new” command includes local port/vpi/vci information and destination nsap or switch prefix plus port number (for FORE switches)/vpi/vci information plus a user or AMI configurable spvc id number. Notice also that you can specify a forward and backward upc index for this bidirectional SPVC.

Advanced features include the ability to indicate a preferred SVC call route through the use of a FT-PNNI Designated Transit List (DTL), to indicate a bearer class (X = all ATM media, A = non-ATM CBR media and C = non-ATM VBR/UBR/ABR media), to indicate whether this SPVC is susceptible to clipping (loss of a brief interval at the beginning of a speech spurt), to indicate the use of a QoS expansion table and to indicate the forward and backward QoS class for this SPVC connection.

Configuring PNNI SPVCs - *ForeView*

- **PNNI SPVCs are created by selecting PNNI-SPVC from the VPC/VCC Control pull-down menu (FP display) and filling in values.**



Core Switch

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To configure PNNI SPVCs using *ForeView*, select PNNI-SPVC from the VPC/VCC Control pull-down menu on the Front Panel Display. You will be shown the PNNI-SPVC Channel Tool screen shown above.

Notice that besides source and destination selections, there are buttons for Bearer Class, Clipping, etc..

PNNI SPVCs are inherently bidirectional, which means that a single call setup establishes the circuit in both directions (unlike SPANS SPVCs, you do not have to open a session to the remote switch to create the SPVC).

Showing PNNI SPVCs - AMI

```
myswitch::configuration spvc pnni> show ?
usage:  show  [<spvcid>] [(orig \ term)] [(advanced)]

myswitch::configuration spvc pnni> show
Originating PNNI SPVCs:
          Source                    Destination
INDEX  PORT  VPI  VCI  UPC  PORT  VPI  VCI  UPC  VPVC-SEL  STATE
16451  1A1     0   100  0     1B1     any  any  0     noPref       down
          Destination:  0x47.0005.80.ffe100.0000.f21b.19cd.0020480d0008.00
24341  1A1     0   101  0     1B1      0    32   0     noPref       up
          Destination:  0x47.0005.80.ffe100.0000.f21b.19c3.0020480d0008.00
Terminating PNNI SPVCs:
          Source              Destination
INDEX  PORT  VPI  VCI  PORT  VPI  VCI  STATE
11        1B1     0   100  1A3      0    32   up
          Source:  0x47.0005.80.ffe100.0000.f21b.19c3.0020480d0008.00

myswitch::conf spvc pnni> show advanced
adds BearerClass, ForwardQoS, BackwardQoS, Clip, Cost, Reroute, FT-PNNI DTL,
Name, Domainid, QoSExpIndex, Last Failure Cause, Uptime, Downtime and Retry
Count information to above display for each Originating and Terminating PNNI SPVC
as appropriate
```


Notice that you may select a certain SPVC (by id#) to show, just originating or terminating SPVCs, advanced information or just a normal show, which shows all originating and terminating information for all SPVCs (but without advanced information).

Notice also that UPC is assigned only for originating SPVCs, and that Source UPC = -fupc <index> and Destination UPC = -bupc <index>.

The VPVC-SEL column under Destination identifies your selection for destination VPI/VCI values. “NoPref” means you did not specify. If the switch is a FORE switch, the values selected will be displayed in the Destination VPI/VCI columns. If the destination switch is not a FORE switch “?” is displayed in the destination VPI/VCI columns. “Require” means that you did specify VPI/VCI values to be used by the destination switch.

Configuring PVC & SPVCs Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Through Paths may be assigned a name with a maximum of 16 ASCII characters. True / False

2. What command is used to show the endpoint connection types for the ingress-egress and path type label assigned to a through path?

3. PVCs do not have to stay on the same path and channel as they move from port to port through a switch. True / False

4. All netmods have a default VCI range of _____ per path.

5. What is the maximum number of items that will display when you type the AMI command “configuration module show” on an ASX-1000? _____

6. To delete an SPVC, use the delete command with the local and remote index number. True / False

7. What is the primary reason for employing an SPVC over a PVC?

8. ABR is the primary ATM service provided by service providers.
   True / False

9. CAC is the process that is used to police connections based on a contract. True / False

10. As cells are policed, if they are found not to be in conformance with the contract, what action/s are taken? _____

Configuring PVC & SPVCs (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Through Paths may be assigned a name with a maximum of 16 ASCII characters. True / **False**

2. What command is used to show the endpoint connection types for the ingress-egress and path type label assigned to a through path?

   conf vpc show <port> advanced

3. PVCs do not have to stay on the same path and channel as they move from port to port through a switch. **True** / False

4. All netmods have a default VCI range of ___**32-511**___ per path.

5. What is the maximum number of items that will display when you type the AMI command “configuration module show” on an ASX-1000? __**5**_

6. To delete an SPVC, use the delete command with the local and remote index number. True / **False**

7. What is the primary reason for employing an SPVC over a PVC?

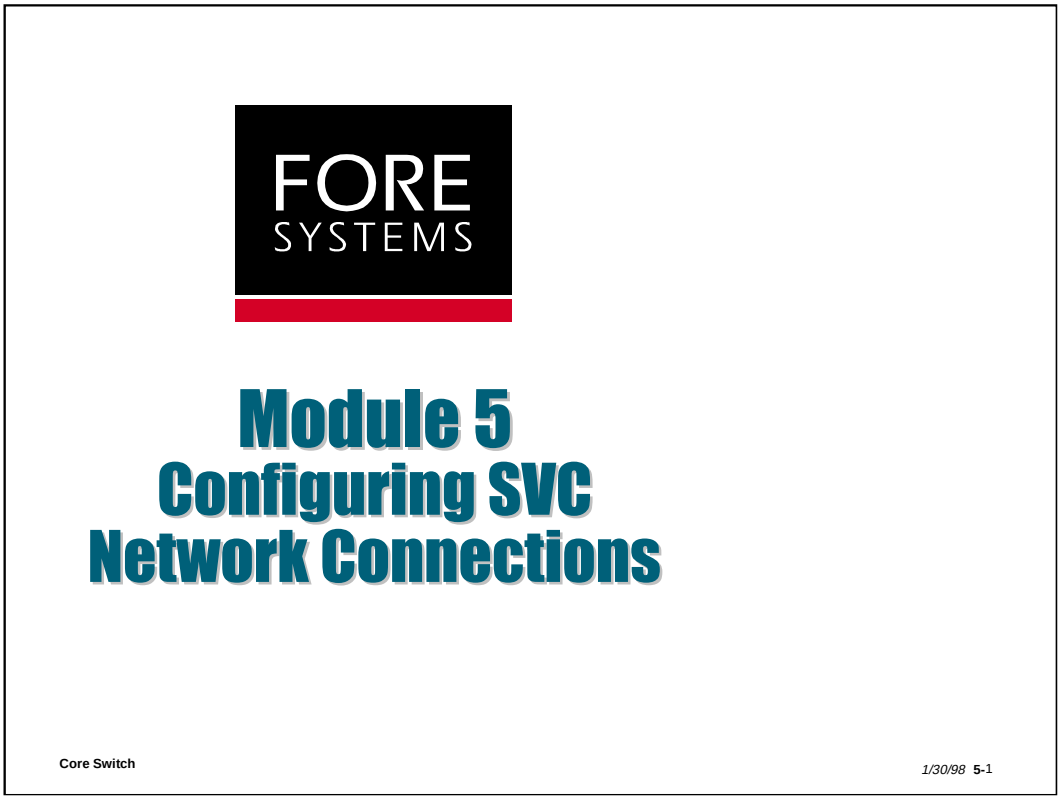
   Dynamic network resiliency

8. ABR is the primary ATM service provided by service providers.

   True / **False**

9. CAC is the process that is used to police connections based on a contract. True / **False**

10. As cells are policed, if they are found not to be in conformance with the contract, what action/s are taken? ____**dropped or tagged**_____

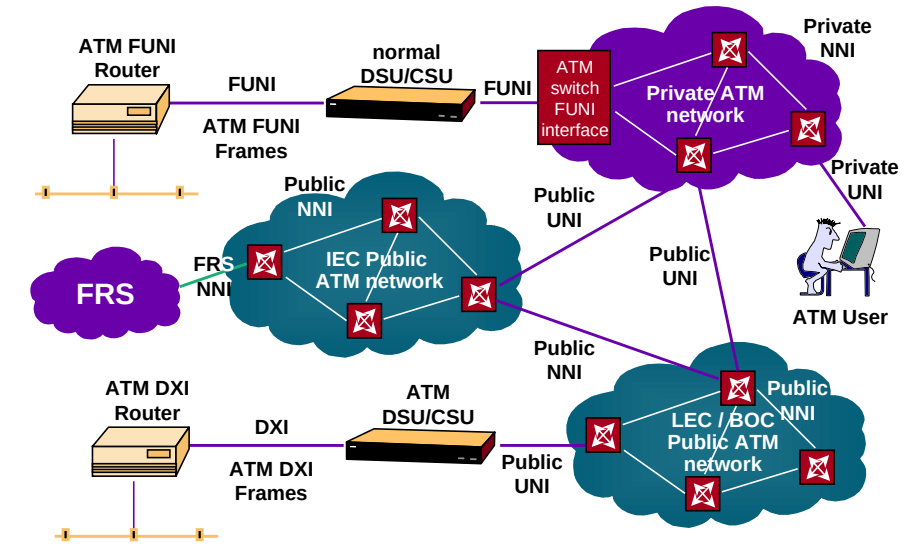


In order to understand SVC-based applications such as LANE and CLIP, one must first understand switched connections in an ATM environment.

This module starts with a brief overview of the things which need to be considered (and potentially configured) when creating SVCs in an ATM environment.

It shows the interfaces encountered plus the addressing, messaging and filtering configuration possibilities with these interfaces.

ATM Interface Overview



UNI - User to Network Interface

ATM UNI could be 3.0, 3.1, SPANS or eventually 4.0

FUNI - Frame-based UNI

NNI - Network Node (or to Network) Interface

ATM NNI could be private (IISP, PNNI 1.0 or FT-PNNI) or public (B-ICI 2.0/3.0)

IISP - Interim Inter-switch Signaling Protocol

PNNI - Private NNI

FT-PNNI - *ForeThought*-PNNI

B-ICI - Broadband Inter-Carrier Interface

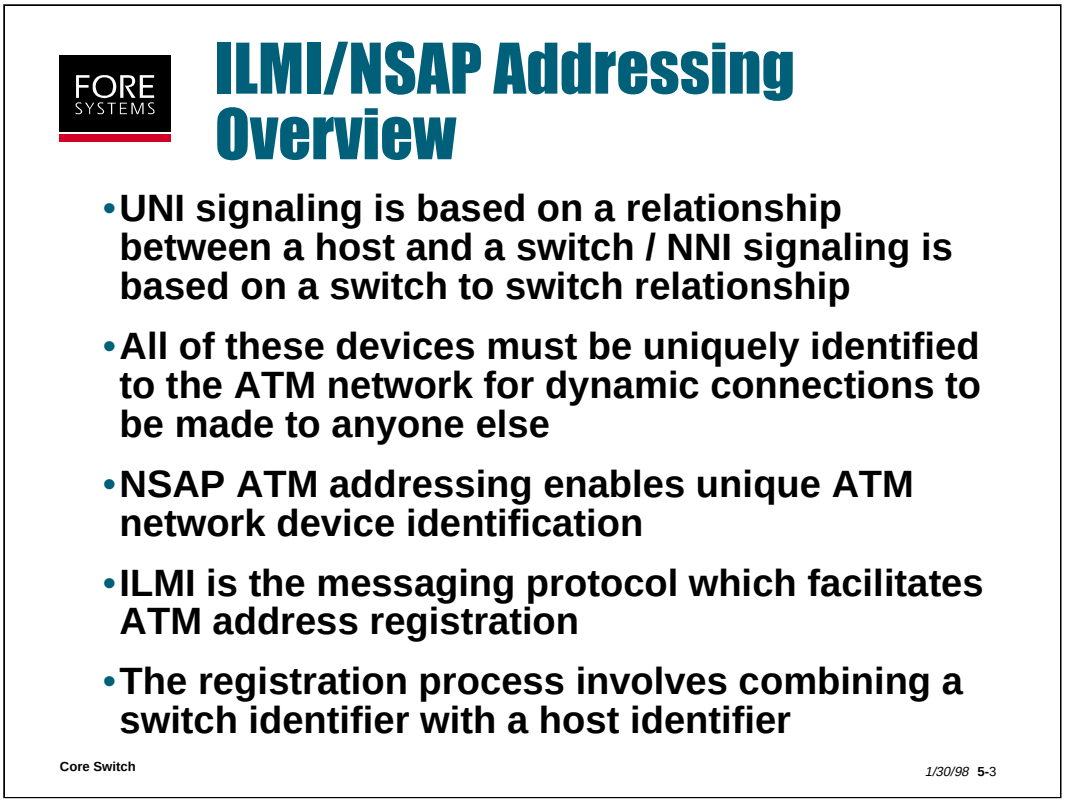
FRS - Frame Relay Service

DXI - Data Exchange Interface

DSU/CSU - Data Service Unit/Channel Service Unit

LEC/BOC - Local Exchange Carrier/Bell Operating Company

IEC/IXC - Interexchange Carrier



ATM interfaces are either UNI (User to Network) or NNI (Network to Network or Network Node) interfaces. This equates to a messaging relationship between a host and a switch (UNI) or between switches (NNI).

In order for devices in an SVC-based ATM network to communicate (build dynamic connections) they must each be identifiable. The ATM Forum and ITU-T have decided to use Network Service Access Point (NSAP) ATM addresses to uniquely identify these devices in a primarily private ATM network and E.164 addresses in a primarily public global ATM network.

Interim Local Management Interface (ILMI) was chosen by these same organizations to act as the messaging protocol which would allow NSAP address registration to take place.

When an NSAP address is built using ILMI over a UNI interface, what actually happens is that the switch sends its portion of the address (switch prefix) to each active host. The host then adds its unique portion (End System Identifier -ESI field) and virtual interface Selector Byte (SEL) to the switch prefix and sends it back over ILMI to the switch. In this way, each ATM device in the network has a unique address.

Signaling Configuration - AMI

```
myswitch::configuration> signalling ?
delete                modify                new                show

myswitch::configuration signalling> new <port> <vpi> [-version ( auto | uni30 | uni31 |
pnni10) ] [-ilmi (up | down) ] [-side (user | network) ] [-type (auto | publicUNI | IISP |
privateNNI | privateUNI) ]

atm layer options: [-sigvci <vci>] [-ilmivci <vci>] [-insigupc <upc-index>] [-outsigupc
<upc-index>] [-minvci <vci>] [-maxvci <vci>]
protocol options: [-sig_alloc (vp | link | auto) ] [-sig_mode (nonAssoc | vpAssoc | auto) ]
[-qos_exp <QoSExpIndex>] [-carrier_loss_action (clearCalls | noClear) ]
atmroute options: [-cost <cost>] [-domain <domain>]
timer options: [-sscopnoresp_timer <sec>]
public options: [-ilmireg (disable | ignore) ] [-addressformat (private | el64) ] [-el64address
<el64Address>] [-el64mapping (enable | disable) ] [-plantype (international | national |
subscriber) ]
iefilter(Information Element filtering) options: [-iefilter (one or more of: [cg, cgs, cds, blli,
blli23, bhli, aal] ) ] [-defaultcpn <NSAPAddress>]
NSAP Address Filtering options: [-incomingfilter <filter-id>] [-outgoingfilter <filter-id>]
```

Core Switch

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Before a signaling channel can be created on a given VPI, an originating and a terminating path must exist for that same VPI.

You may specify which protocol to use for this signaling channel (UNI 3.0 or 3.1 or PNNI 1.0) or allow the switch to determine which to use based on setup messages received. The default is “auto”.

When a host is connected to this interface, the “-ilmi” option allows you to enable/disable ilmi. The default is “up”. If this interface is an IISP interface, select “down”.

If this interface is connected to a host select “network”. If connected to another switch over an IISP link, one switch must select “user” and one must select “network”.

If this interface is connected to a public ATM switch and signaling is to be used, select “publicUNI”. If this is to be an IISP link with no signaling select “IISP”. “auto” is the default.

The atm layer options allow you to specify unique features for this path (i.e. the signaling channel used, min/max VCIs supported, etc.)

The protocol options allow you to specify the signaling mode and allocation of connections.

The timer option allows you to set the SSCOP no response timer.

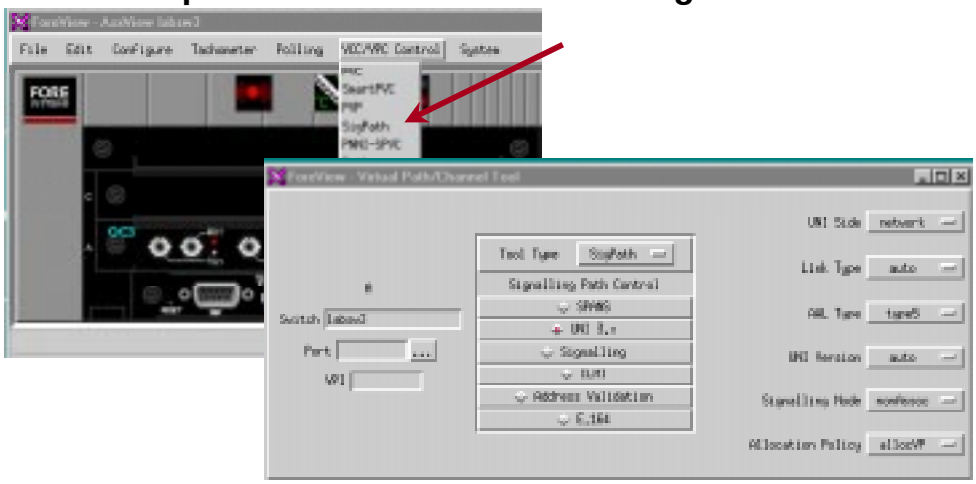
The public options are related to e164 address mapping, etc.

The iefilter options allow you to filter call setups based on information element parameters, while the NSAP Address Filtering options allow you to filter connections based on configured filter-ids.

.

Signaling Configuration - *ForeView*

- **You configure signaling starting at the VCC/VPC Control pull-down menu and select SigPath**



Core Switch

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Selecting SigPath from the VCC/VPC Control pull-down menu on the Front Panel display brings you to the Signaling configuration screen.

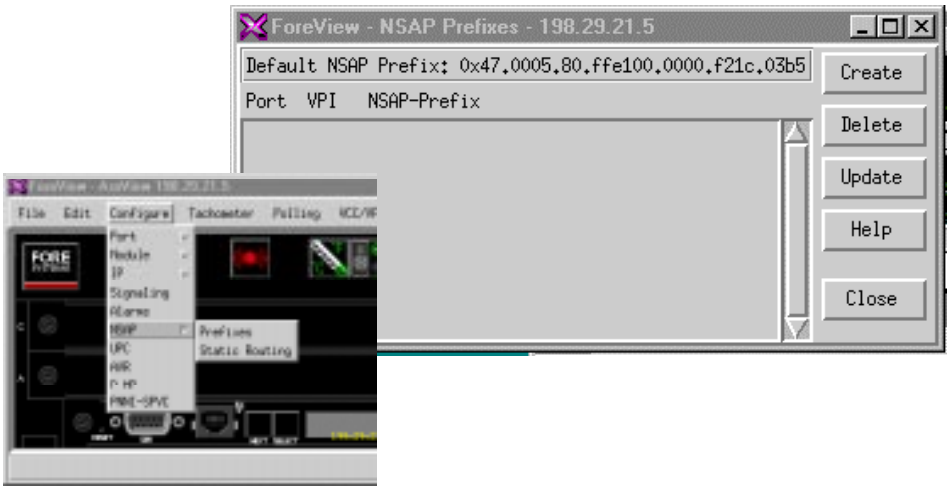
From there you can make individual choices associated with this particular signaling path.

NSAP Prefix (switch) Address Configuration - AMI

```
myswitch::configuration nsap> ?
prefix>              ilmi>              e164>              registry>

myswitch::configuration nsap prefix> ?
delete               new                show

myswitch::configuration nsap prefix> new <port> <vpi> <prefix>

myswitch::configuration nsap prefix> show
Port      VPI  NSAP-Prefix
1A1         0  0x47.0005.80.ffe100.0000.f21a.00de
1A2         0  0x47.0005.80.ffe100.0000.f21a.00de
1A3         0  0x47.0005.80.ffe100.0000.f21a.00de
1A4         0  0x47.0005.80.ffe100.0000.f21a.00de
1CTL        0  0x47.0005.80.ffe100.0000.f21a.00de

or…
No user configured NSAP prefix information is available
```


NSAP switch prefix information is written into switch firmware at the factory. If for some reason, you need to create a new or different switch NSAP prefix on a port, use the “conf nsap prefix new” AMI command shown above. Since only one NSAP is allowed on each port, delete the old one first, before creating a new one.

NSAP Prefix (switch) Address Configuration - *ForeView*



Core Switch

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To configure an NSAP prefix with *ForeView*, use the Front Panel pull-down menu to select “Configure NSAP and Prefixes”. The screen on the right above will appear. Notice that it shows you the current default NSAP prefix at the top of the screen.

Displaying ILMI Configuration - AMI

```
myswitch::configuration nsap> ?
prefix>              ilmi>              e164>              registry>

myswitch::configuration nsap ilmi>  ?
show

myswitch::configuration nsap ilmi> show  [<port>]
Port      NsapAddress
1A1       47000580ffe1000000f21a00de00204810046400
```

Core Switch

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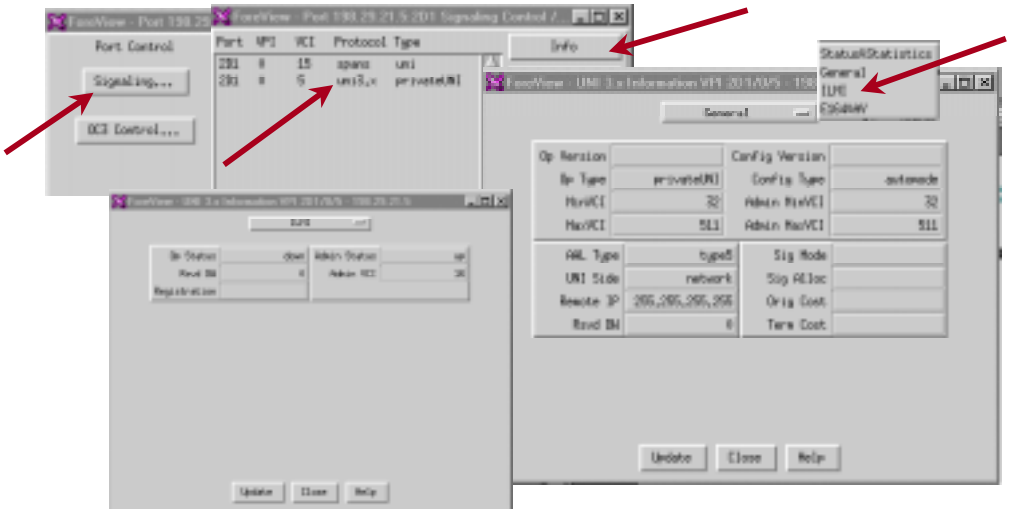
When a switch is powered on, it begins registering hosts that are attached to its ports, over the ILMI interface VPI 0 / VCI 16. Once the switch has sent its NSAP switch prefix to each host, and the host has added its ESI field and SEL byte to this NSAP address, the completed address (20 bytes) is sent back to the switch. The switch enters this information into its topology tables, so that any connections destined for that host may be routed by the switch.

To display which ports have completed this process for their attached hosts, run the AMI command “conf nsap ilmi show” as shown above.

Displaying ILMI Configuration - *ForeView*



Core Switch

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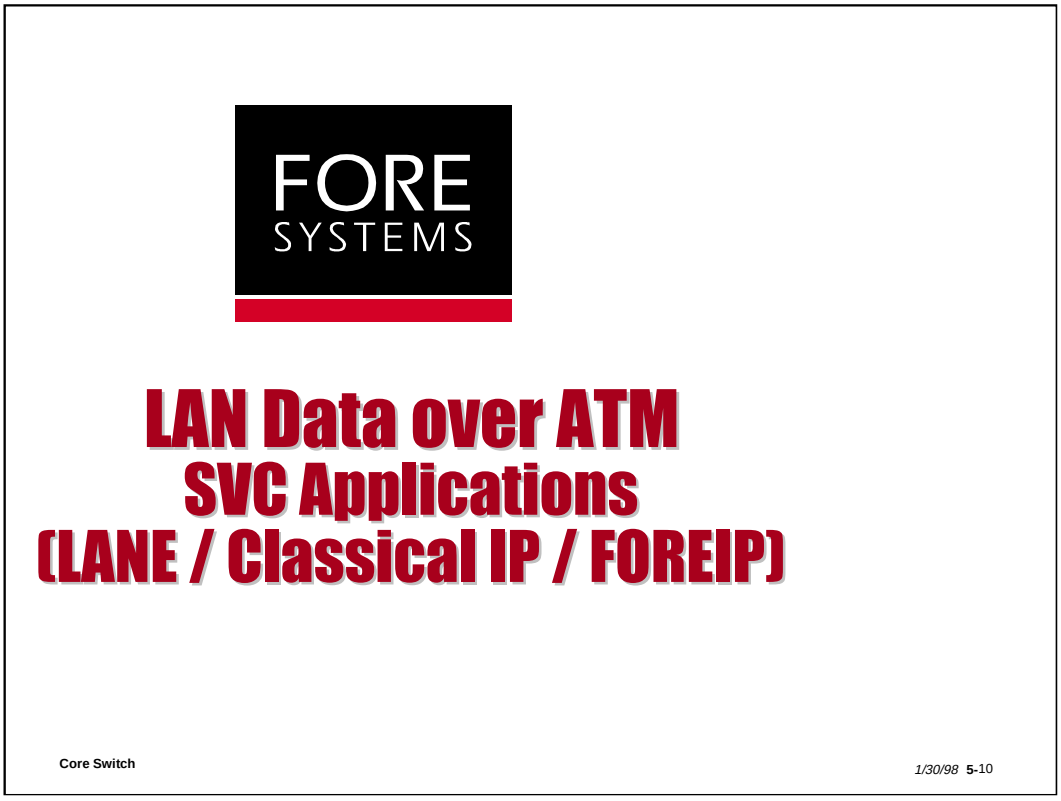
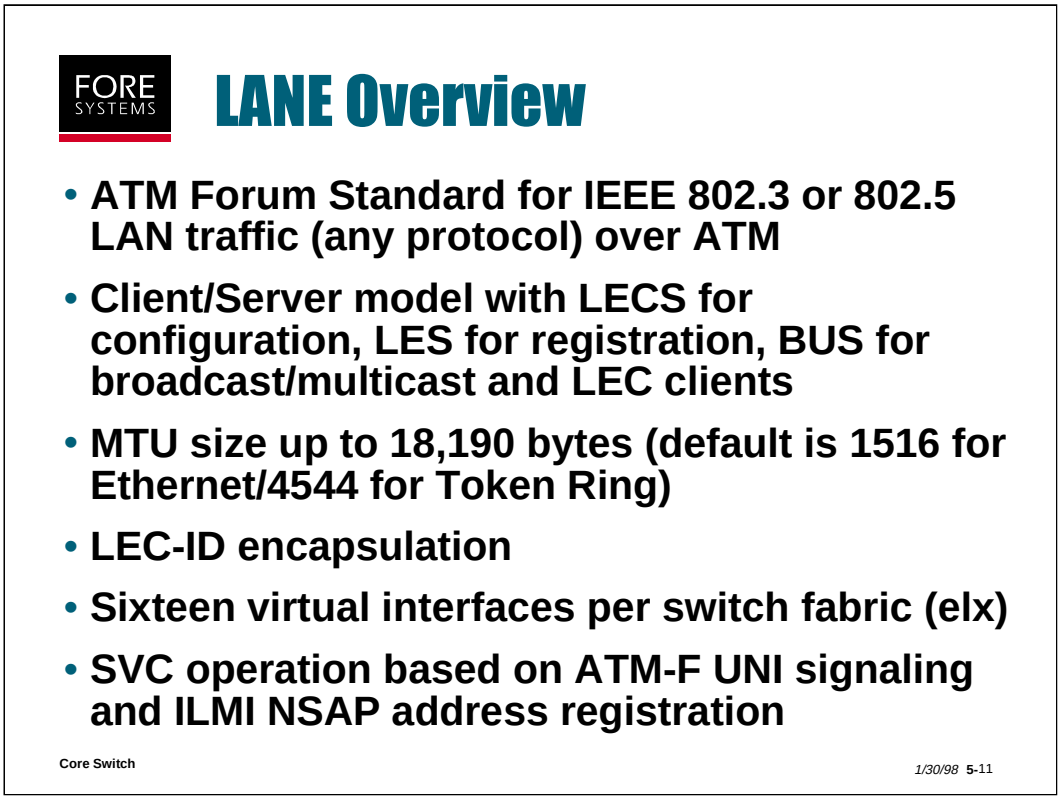
To display ILMI configuration using *ForeView*, you must have previously selected “Signaling” from the port control screen, selected UNI3.x Signaling info for viewing, and then ILMI from the pop up menu associated with the top button of the UNI Signaling screen.



The following section covers three different LAN data over ATM applications:

- LANE
- Classical IP
- FOREIP

We will spend considerably more time on LANE, as it is an application with less restrictions and much more robust standardized support in the industry.



The LANE standard from the ATM Forum supports both Ethernet (IEEE 802.3) and Token Ring (IEEE 802.5) LAN emulation for any protocol (not just IP) over ATM.

The model for LANE is client/server with LECs as clients and three different functional servers (LES for MAC to ATM NSAP address registration, BUS for broadcast/multicast support and LECS for configuration services).

We support up to 16 virtual client interfaces (LECs) per switch fabric.

LANE is an SVC based service utilizing ATM-F based UNI signaling connections to NSAP ATM addresses registered using ILMI.

LANE Switch-based Services Creation Overview

- Use AMI or *ForeView* VLAN Manager
- Use a logical order
  - Review network requirements
  - Create lecs.cfg file to reflect requirements
  - Perform switch functions
    - Get lecs.cfg
    - Start LECS
    - Start LES/BUS pairs and DLE peers as appropriate
    - Start any required switch LECs
    - Verify switch functionality
  - Add non-switch LECs and verify functionality

Core Switch

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Creating ATM switch-based LANE services should be a very logically ordered process.

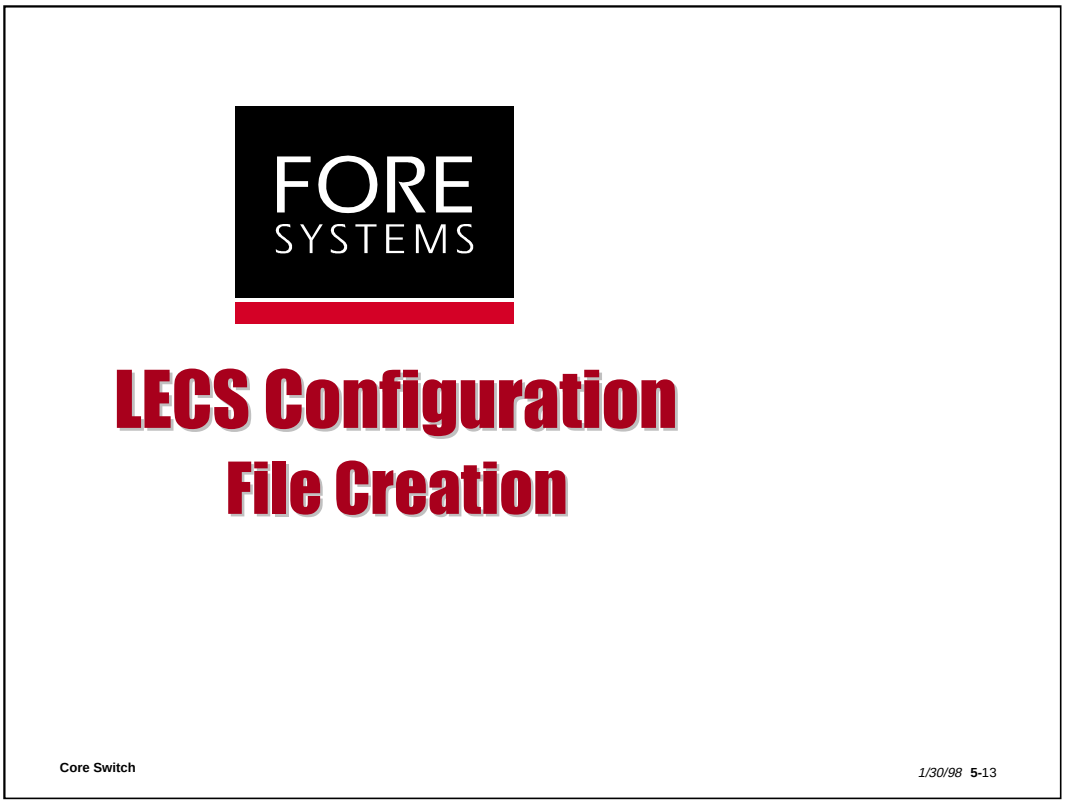
First determine what you are trying to accomplish with this network.

Then, create an lecs.cfg file which supports those goals.

Then, if you are using the switch as the ELAN service provider, start any services which the switch will support (including switch-based clients).

Then, add any non-switch based clients to those ELANs.

In all cases, verify each step as you proceed with the process.



Although this is not a switch specific event, it is essential for a proper lecs.cfg file to be created which matches your eventual LANE network requirements. Lecs.cfg files are created using text editor programs or VLAN Manager (which will be discussed later), and stored in a tftpboot directory, ready for download to any device running the LECS server software.

Before configuring this file, perform the following tasks:

1. Determine the topology of the ELAN environment.
2. Assign a name for each ELAN.
3. Determine the ATM NSAP address for the LES of each ELAN.
4. Determine which ELANs require LEC failover or DLE support.
5. Determine a selector byte sequence for servers and switch-based LECs.
6. Determine if you require or desire a redundant LECS.
7. Determine if any or all LECs will require a default ELAN.
8. Determine if any of the ELANs will require specific parameters (i.e. timeouts, MTU size changes, etc.).
9. If you are using an existing or the default lecs.cfg file to start with, make a copy of the original file and move it to the tftpboot directory for editing.

Sample LECS Configuration File

```
.VCC_Timeout_Period: 300

default.Address: 47.0005.80.ffe100.0000.f21a.01b9.0020480605b2.11
default.Accept: xx.xxxx.xx.xxxxxx.xxxx.xxxx.xxxx.xxxxxxxxxxxx.xx

eng.Maximum_Frame_Size: 18190

eng.Address: C5.0005.80.ffe100.0000.f21a.01b9.0020480605b2.13
eng.Accept: C5.0005.80.ffe100.0000.f21a.01b9.xxxxxxxxxxxx.xx.VCC_TimeOut_Period: 600
eng.Reject: C5.0005.80.ffe100.0000.f21a.01b9.00204893bc4.07

Match.Ordering: default, eng

.Shortcut_Protocols: IP
.Shortcut_Threshold: 34/3
.MPOA_KeepAlive_Time: 30
```


Shown above is a sample lecs.cfg file which includes examples of most all optional types of fields. The following slides provide more detail about each of these fields.

LECS Configuration File Syntax

- **Each line takes this general form:**
  - **[[group] .] key : value**
- **Groups - Represent ELANs (by name) and clients (by ATM or MAC address) as well as miscellaneous LECS control information**
- **Keys - denote individual parameters within a Group**
- **Values - denote values for those parameters**

Core Switch

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The LECS Configuration file is a sequence of lines. The lines may be continued by placing a backslash at the end of the line. Each line takes the general form of:

[[group] .]key : value

A missing group implies that the key and value apply to all groups.

For example, to specify a maximum frame size of 18190 bytes for all ELANs defined in this lecs.cfg file (rather than the default value of 1516 for Ethernet or 4544 for Token Ring), enter the following:

.Maximum_Frame_Size : 18190

LECS specific parameters can also be defined. The example below specifies the length of time that an idle data connection (Configuration Direct VCC) remains open before being closed (the default value is 1200 seconds).

.VCC_TimeOut_Period: 300

Defining an ELAN

- **Creating individual ELANs**

<elan-name>.Address: <ATM-address-of-LES>

Example:

Sales.Address: 47.0005.80.ffe100.0000.f21a.01b9.0020480846b2.10

or for DLE

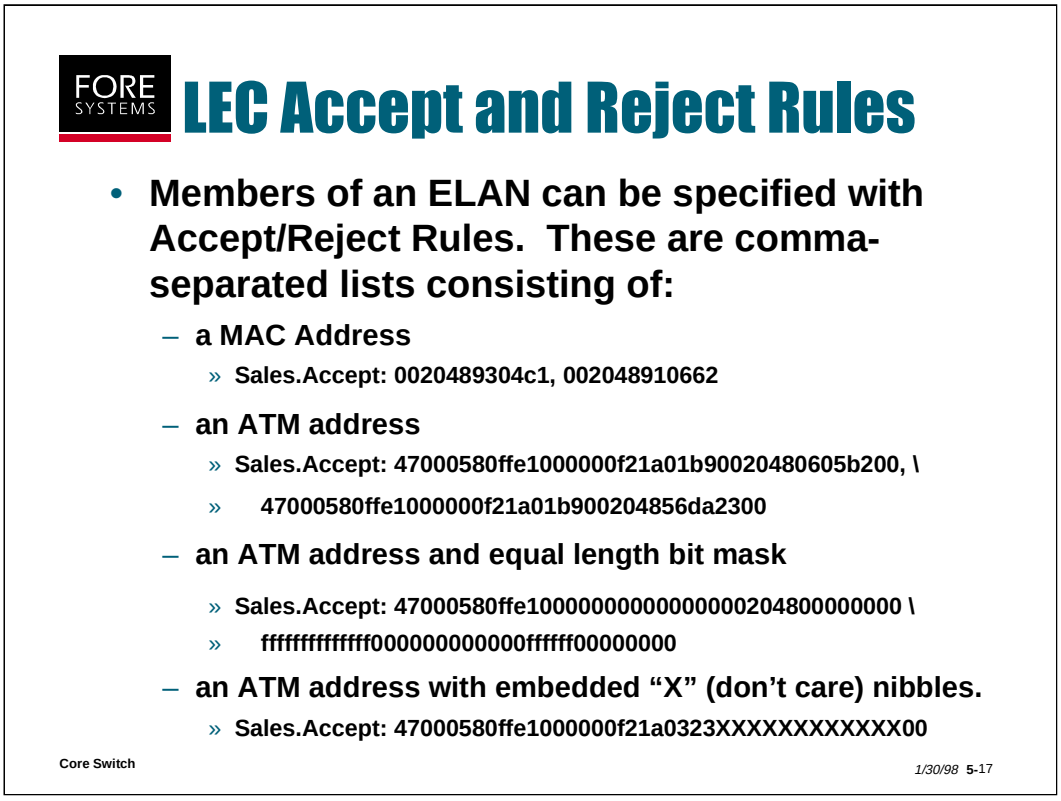
Sales.Address: C5.0005.80.ffe100.0000.f21a.01b9.0020480846b2.10

To define individual ELANs, specify each ELAN name as a “group” and give an NSAP ATM Address “value” to each Address “key” denoting the ATM address of the ELAN’s LES.

Notice that for DLE purposes, the NSAP address uses an anycast version of the address (C5 vs. 47).

ELANs may be configured to override the overall LECS values with statements such as:

Sales.Maximum_Frame_Size: 9234



To control which clients (LECs) may or may not join a particular ELAN, Accept and Reject entries may be added to the LECS configuration file.

When using the bit mask option, a client will be admitted to the ELAN if its ATM address matches that in the Accept statements everywhere that the mask has a 1-bit (f). Notice that there is no comma placed between the ATM address and the mask.

Each individually defined ELAN must have at least one Accept/Reject rule for anyone to be able to join it.

The filtering process for accept/reject is as follows:

1. First pair and process any NSAP length accept/rejects

2. Then pair and process any MAC length accept/reject

LEC NSAPs or MAC addresses may also have individual parameter overrides attached to them. The example shown below overrides the LECS based Configuration Direct VCC TimeOut with one specific to this client or group of clients:

47.0005.80.ffe100.0000.f21a.01b9.xxxxxxxxxxxx.xx.VCC_TimeOut_Period: 600

LECS Accept/Reject Example

Example:

```
Sales.Address: 47.0005.80.ffe100.0000.f21a.01b9.0020480605b2.11
Sales.Accept: 002048102aef, \
    47.0005.80.ffe100.0000.f21a.01b9.0020480605b2.00, \
    00.0000.00.000000.0000.f21b.0000.000000000000.00 \
    00.0000.00.000000.0000.ffff.0000.000000000000.00
Sales.Reject:  xx.xxxx.xx.xxxxxx.xxxx.xxxx.xxxx.002048101487.xx
```

Core Switch

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In the example above, you see the NSAP address for the Sales LES, and an accept statement which includes one MAC address, one NSAP address and a masked NSAP for anyone on a WG.

There is also one reject for a particular MAC address no matter where it shows up.

LECS Match.Ordering

- **All ELANs with Accept/Reject rules must be ordered with:**

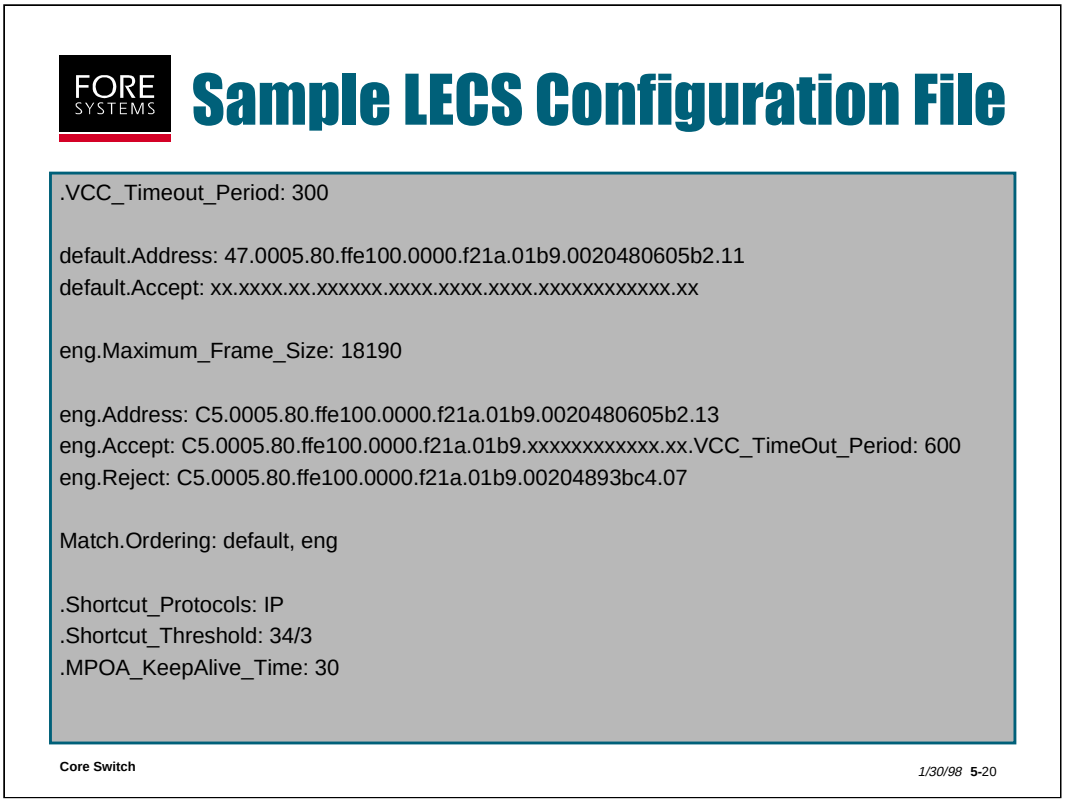
Match.Ordering: <elan-name>, <elan-name>

This defines the order in which to examine the available ELANs

(i.e. Match.Ordering: mktg, hr, sales)

The “Match.Ordering” line shown above is mandatory any time Accept and Reject rules are used.

This line identifies the order in which all potential clients are filtered, and as such, those ELANs with the most clients (or unique needs) should appear first.



So, as discussed in the previous slides, even though an lecs.cfg file may look complicated, each line has a purpose, and when examined line by line, it is fairly simplistic.

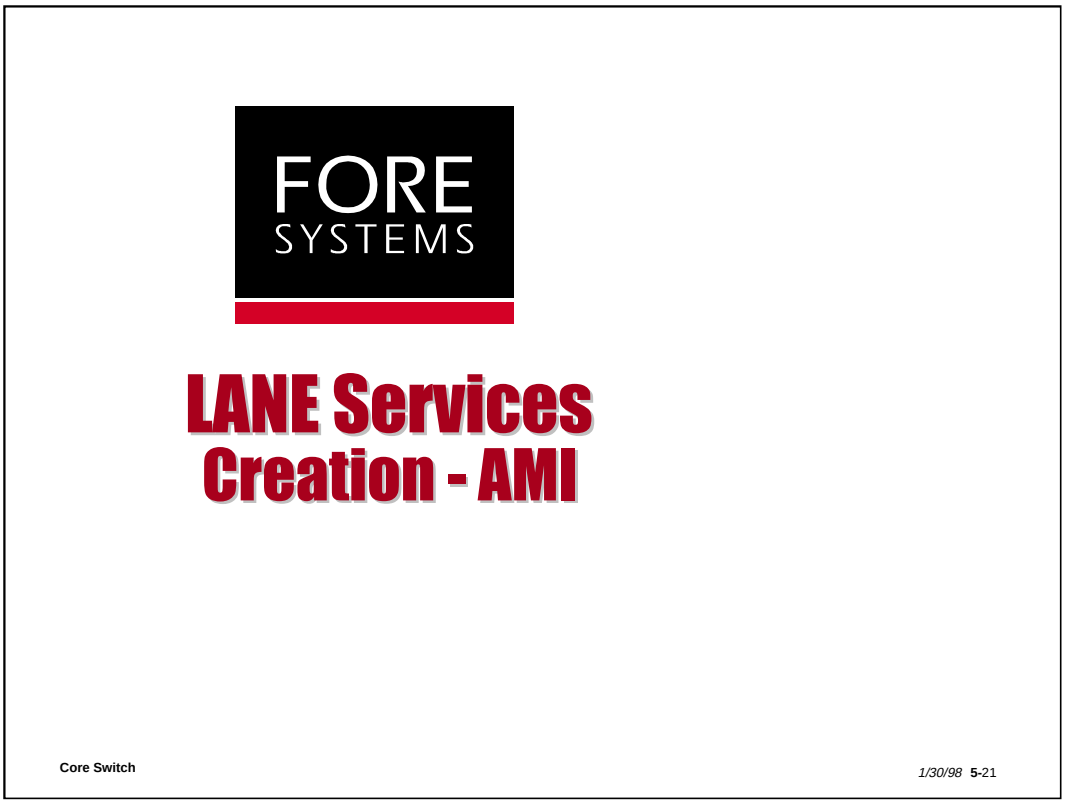
The three lines at the bottom of the screen above are related to MPOA as follows:

The “Shortcut_Protocols” line indicates on which set of protocols to perform flow detection (the default is IP).

The “Shortcut_Threshold” line indicates that 34 frames in 3 seconds must be forwarded to the same destination using the default path before switching to the shortcut path (the default is 10 frames per second, the frame range is 1-65,535 and the second range is 1-60).

The “MPOA_KeepAlive_Time” line indicates how often an MPS must send keep alive messages to all MPCs to which a shortcut path has been created (the default is 10 seconds and the range is 1-300 seconds).

For more information on MPOA and its configuration on FORE ATM switches, see the *ForeRunner* ATM Switch Network Configuration Manual.



Using AMI commands on a switch, you can create all of the available ATM Forum LANE services as shown below and on the following slides.

myswitch::configuration lane> ***?***

default> bus> lec> lecs>
les>

Creating a Default ELAN

```
myswitch::configuration lane> ?
default>          bus>          lec>          lecs>
les>

myswitch::configuration lane default> ?
new               delete        show

myswitch::configuration lane default> new
Do you want to create default ELAN (LES/BUS, LECS, LEC): (n)? y
Created LANE Services and a LEC for the default ELAN.
```

Core Switch

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A default ELAN may be created very simply as shown above.

As a result of running the “configuration lane default new” command, you will have created a single ELAN with the name “default”. It is an Ethernet ELAN with an MTU size of 1516. The LES and BUS are colocated and the LECS uses the ATM-F well-known address.

A single LEC is also created on this ELAN. To make this LEC active, simply go to “configuration ip” and assign an IP address to the el0 interface that was created and make it active with the command “configuration ip admin el0 up”.

Remember that your switch-resident lecs.cfg file must contain an ELAN with the name “default” and your switch’s LES NSAP address with the appropriate “accept” statement (all x’s most likely).

Displaying the Default ELAN

```
myswitch::configuration lane default> show
LECS Information:
 Index  AdminStatus  OperStatus  Selector  WKA          Database
  1       up           up          0xf1    atm-forum    lecs.cfg
          Default LES: 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.f0
LES/BUS Information:
 Index  AdminStatus  OperStatus  LesSel  Type       MTU   ELAN     SECURE   TLVs
  1       up           up         0xf0    ethernet   1516  default  disable  enable
          LES: 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.f0
          BUS: 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.f0  (Co_Located)
LEC Information:
          Admin   Oper
 Index    Status  Status  Sel   Mode        MACaddress     If Name   ELAN
  1         up      up     0x00  wellknown   0620481a3596   el0       default
          LECS: 0x47.0079.00.000000.0000.0000.0000.00a03e000001.00
          LES  : 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.f0
```

Core Switch

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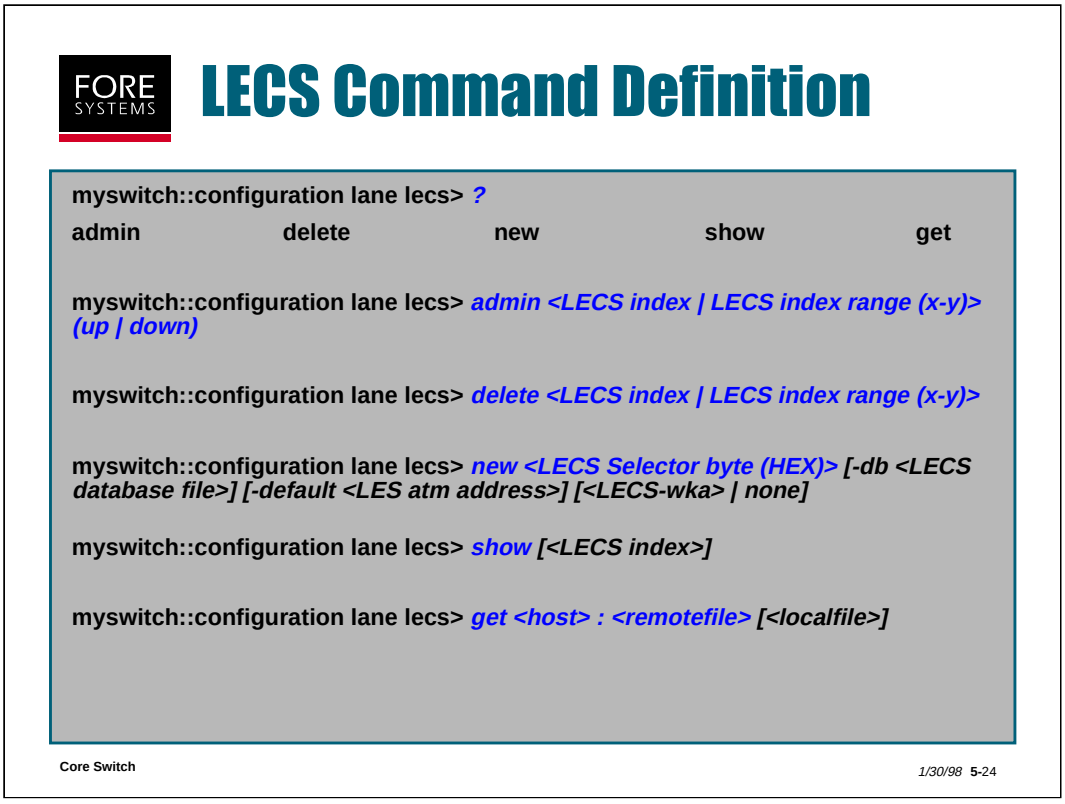
By typing “configuration lane default show”, you will see the status of all services and the client that you created.

Notice that the LECS uses the ATM-F wellknown address, assigns itself the selector byte f1 and makes your switch the default LES.

Notice also that the “default” ELAN LES and BUS are co-located on your switch (selector byte f0 assigned) and set up to support Ethernet with an MTU of 1516. The “SECURE disable” entry means that ELAN access control is not running. The “TLVs enable” entry means that this ELAN can work in an MPOA environment.

A single LEC is created on your switch (selector byte 00) with the interface designation of el0. After you have given the el0 interface an ip address and admin’d it “up”, it should look like the display shown above.



The "**LECS index**" is a unique, positive integer dynamically assigned by AMI when the LECS is created.

LECS Selector Byte - Enter the 20th byte (in HEX) of the switch's NSAP address that you want assigned to the LECS service. Use the AMI command *conf atmarp getnsap* to display the entire NSAP address of the switch.

-db <LECS database file> - This optional parameter indicates the full path to the location and name of the LECS configuration file. The default filename is *lecs.cfg*.

-default <LES atm address> - Indicates a default LES address to use in case the LECS configuration file is inaccessible.

In order to implement this feature properly, the LECs must specifically ask to join an ELAN named "default". If one exists in the lecs.cfg file and the lecs.cfg file is readable by the LECS, then the LEC will be given the LES address defined in the configuration file (lecs.cfg). If the configuration file is unreadable, the LEC will be given the LES address defined by this parameter (-default <LES atm address>.

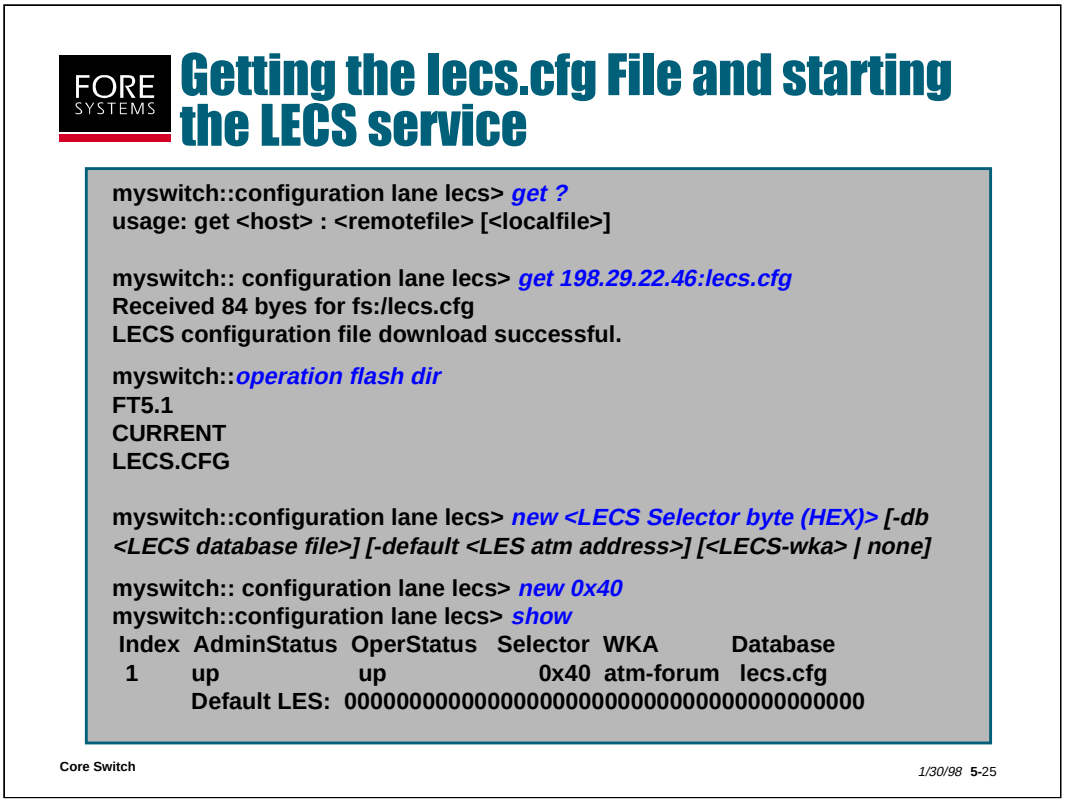
<LECS-wka> | none - LECS-wka indicates an NSAP address to use as the wellknown address instead of the ATM Forum's. None indicates that the wellknown address is disabled, so the LECS can only be contacted using the switch's actual NSAP address.

The "**get"** command can be used to retrieve the LECS configuration file from a host on the network via TFTP.

host is the ip address of the host from which the file is to be retrieved.

remotefile is the name of the configuration file to be retrieved from that host.

localfile is an optional parameter indicating the filename where the retrieved file is to be stored.



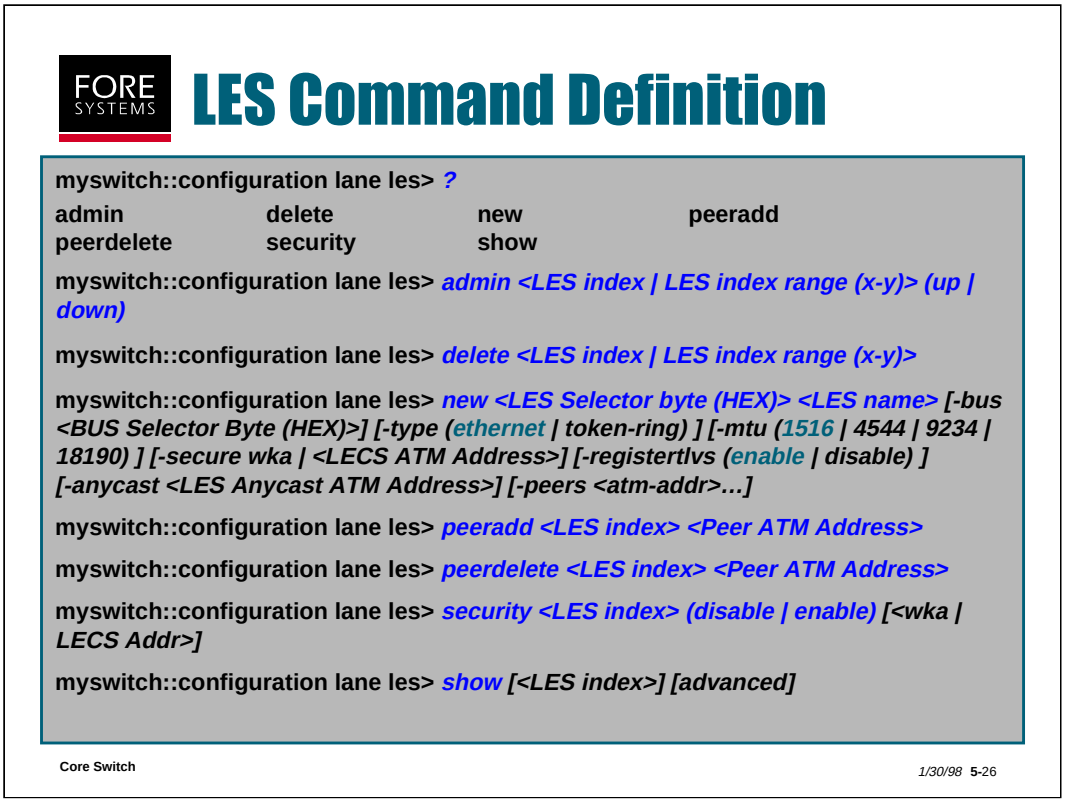
In the example above, the LECS will reside on the switch, so we must retrieve the file from the host and place it into Flash memory on the switch.

If the switch is configured to use the TFTP protocol (instead of FTP), the host which contains the file must be set up to support this. For example, if the *lecs.cfg* file is on a SUN workstation, make sure that the TFTP daemon (in.tftpd) is running. Also, by default, most SUNs are configured to direct TFTP requests to the directory /tftpboot. If this is the case, the *lecs.cfg* file must be saved into that directory. You can check your SUNs current TFTP configuration by viewing (and editing, if necessary) the file named *inetd.conf,* which is located in the /etc directory. If the switch is configured to use FTP, just type the command as described below (you will be asked for the remote userid and password).

From the *configuration lane lecs* directory on the switch, you can use the *get* command to retrieve the LECS file as shown above.

To configure the switch to run LECS services, simply type the *new* command and enter the selector byte to be used. If using a name other than lecs.cfg for the configuration file, enter it here as well.

Notice when we show the current LECS configuration that the Default LES address is all zeros. This is correct since we did not define one using the -default parameter.



The "**LES index**" is a unique, positive integer dynamically assigned by AMI when the LES is created.

LES Selector Byte - Enter the 20th byte (in HEX) of the switch's NSAP address that you want assigned to the LES service.

LES name - Enter a name for the LES. This field helps you remember which ELAN this LES services. Although you can place any name here, as a rule of thumb, enter the ELAN name.

-bus - Enter the BUS's selector byte if you want to use a different selector byte instead of the one the LES is using.

-mtu - Enter a maximum frame size (in bytes). This value must be the same for all hosts or edge devices on this ELAN.

-secure - Indicates a desire to use ELAN access control. LECS NSAP addresses other than the "wka" must be typed in fully.

-registertlvs - Entering "enable" (the default) allows the LES to operate fully in an MPOA environment.

-anycast - Indicates the anycast address that all LECs in the ELAN use to connect to one of the DLE servers for that ELAN.

-peers - Enter the ATM addresses of this DLE server's peers.

The "peeradd, peerdelete and security" commands allow LES modification after creation.

Creating a LES/BUS

myswitch::configuration lane les> *new <LES Selector byte (HEX)> <LES name> [-bus <BUS Selector Byte (HEX)>] [-type (ethernet | token-ring)] [-mtu (1516 | 4544 | 9234 | 18190)] [-secure wka | <LECS ATM Address>] [-registertlvs (enable | disable)] [-anycast <LES Anycast ATM Address>] [-peers <atm-addr>…]*

myswitch:: configuration lane les> *new 90 eng*

myswitch::configuration lane les> *show*

Index	AdminStatus	OperStatus	LesSel	Type	MTU	ELAN	SECURE	TLVs
1	up	up	0x90	ethernet	1516	eng	disable	enable

LES: 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.90
BUS: 0x47.0005.80.ffe100.0000.f21a.3596.0020481a3596.90 (Co_Located)

Core Switch

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Creating a LES/BUS ELAN instance on a switch is very simple.

Decide what selector byte you are going to use for this ELAN, and its name.

Then just type “configuration lane les new <sel byte> <name>“.

Typing “configuration lane les show” will show you if your “new” command was successful. Notice the admin status and operation status should indicate “up”. Notice also that the LES and BUS were automatically configured as co-located and given the same selector byte.

Creating a LES/BUS w/DLE

```
myswitch::configuration lane les> new <LES Selector byte (HEX)> <LES name> [-bus
<BUS Selector Byte (HEX)>] [-type (ethernet | token-ring) ] [-mtu (1516 | 4544 | 9234 |
18190) ] [-secure wka | <LECS ATM Address>] [-registertlvs (enable | disable) ]
[-anycast <LES Anycast ATM Address>] [-peers <atm-addr>...]

myswitch:: configuration lane les> new 90 eng
-anycast c5.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.66
-peers 47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90
47.0005.80.ffe100.0000.f21a.3552.0020481a3552.10

myswitch::configuration lane les> show
Index  AdminStatus  OperStatus  LesSel  Type      MTU   ELAN  SECURE  TLVs
 1        up           up       0x90    ethernet  1516  eng   disable enable
       LES  : 0x47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90
            :   c5.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.66  (ANYCAST)
       BUS  : 0x47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90  (Co_Located)
      PEER : 0x47.0005.80.ffe100.0000.f21a.3552.0020481a3552.10
```

Core Switch

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To create a LES/BUS which is DLE capable, simply add the “-anycast” address of the DLE server, and all “-peers” NSAP addresses for each peer (including the DLE server).

The “show” command in this case shows the LES, the anycast version of the LES, the BUS, and each peer address.

LES Show Advanced

```
myswitch::configuration lane les> sh 1 advanced
ELAN Name: "eng"
   LES:        47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90
               c5.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.66  (anycast)
               Point-to-Multipoint VCC to Peers:  0.714
   BUS:        47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90
   PEER  #1:  47.0005.80.ffe100.0000.f21a.3552.0020481a3552.10
               Point-to-Point VCC to Peer:  0.713
               Point-to-Multipoint VCC from Peer:  0.61
  LAN Type: Ethernet/IEEE 802.3     Maximum Data Frame Size: 1516
  Non-proxy Control Distribute VCC:  0.716
        Proxy Control Distribute VCC: -.-
              Multicast Forward VCC: 0.718
  Number of local clients: 1
LEC #1 at 47.0005.80.ffe100.0000.f21c.10bb.002048102b83.00 (non-proxy)
   00:20:48:10:2b:83 -> 47.0005.80.ffe100.0000.f21c.10bb.002048102b83.00
   Control Direct VCC: 0.715
```


To display advanced information about every LES (or a specific one) that is currently configured on the switch, enter the command “configuration lane les show advanced”. This information includes:

- names of any ELANs associated with this switch
- the LES, anycast, BUS and peer NSAP addresses
- the peer connections
- configuration information specific to this ELAN
- the point-to-multipoint connections maintained to all non-proxy and proxy LECs
- the MAC to NSAP address mapping for each LEC in this ELAN and whether or not it is a proxy
- the point-to-point connection the LES maintains to each LEC

LEC Command Definition

```
myswitch::configuration lane lec> ?

admin           arp>            delete          default>
new             show

myswitch::conf lane lec> admin <LEC index | LEC index range (x-y)> (up | down)

myswitch::conf lane lec> arp delete (all | <MAC address>)
myswitch::conf lane lec> arp show [ (advanced) ]

myswitch::conf lane lec> delete <LEC index | LEC index range (x-y)> (up | down)

myswitch::conf lane lec> default mode (manual | wellknown) [<LECS address>]
myswitch::conf lane lec> default show

myswitch::conf lane lec> new <LEC Selector byte (HEX)> <ELAN name>
[-ip <IP Address> [-mask <IP netmask>]] [ (wellknown | manual) ]
  manual mode options: [-lecs <LECS address>] or [-les <LES address>]

myswitch::conf lane lec> show [<LEC index>] [ (advanced) ]
```

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The "**LEC index**" is a unique, positive integer dynamically assigned by AMI when the LEC is created.

LEC Selector Byte - Enter the 20th byte (in HEX) of the switch's NSAP address that you want assigned to the LEC.

ELAN name - enter the name of the ELAN (or failover LES) that this LEC is to join.

-ip / -mask - entering ip address and netmask information here means you do not have to do it for the el interface through the "configuration ip" (both "address" and "admin").

wellknown | manual - "wellknown" indicates that the well-known address will be used by this LEC to contact the LECS. "manual" allows you to specify a specific NSAP address which this LEC will use to contact the LECS or a specific LES address to be contacted by this LEC (bypassing the LECS all together). "wellknown" is the default mode.

-lecs <LECS address> - Enter the LECS NSAP address to be used instead of the well-known LECS address.

-les <LES address> - Enter the LES NSAP address to be used instead of the LES that is assigned to this ELAN in the LECS configuration file.

Creating the LEC

```
myswitch::conf lane lec> new <LEC Selector byte (HEX)> <ELAN name>
[-ip <IP Address> [-mask <IP netmask>]] [ (wellknown | manual) ]
  manual mode options: [-lecs <LECS address>] or [-les <LES address>]

myswitch::conf lane lec> new 0x91
myswitch::conf lane lec> show

        Admin   Oper
Index Status  Status    Sel    Mode       MACaddress      If Name      ELAN
    1 up      up        0x91   wellknown  0e20481c10bb    el145        eng
      LECS:0x47.0079.00.000000.0000.0000.0000.00a03e000001.00
      LES  :0x47.0005.80.ffe100.0000.f21c.10bb.0020481c10bb.90
```

Core Switch

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To join the ELAN (make a client) on a switch, you must specify the selector byte for the LEC and define the name of the ELAN you wish to join. The default mode is wellknown, which tells the LEC to connect to the LECS using the well-known address.

The LEC first attempts to discover the LECS address using ILMI. If this doesn't work, then it tries using the ATM Forum wellknown address.

If "manual" is selected, you may specify a specific NSAP address which this LEC will use to contact the LECS or a specific LES address to be contacted by this LEC (bypassing the LECS all together).

Displaying the LEC ARP Cache

```
myswitch::configuration lane lec arp> ?
delete                show

myswitch::configuration lane lec arp> show
MacAddress     AtmAddress                                          ELAN
0020481a00d5   0x47.0005.80.ffe100.0000.f21a.00d5.0020481a00d5.0b   fore

myswitch::configuration lane lec arp> show advanced
MacAddress     AtmAddress                                          ELAN
0020481a00d5   0x47.0005.80.ffe100.0000.f21a.00d5.0020481a00d5.0b   fore
               vpi=0,   vci=82,   flags=valid

myswitch::configuration lane lec arp> delete 0020481a00d5
```

Core Switch

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The “configuration lane lec arp show” command displays the MAC to ATM address mappings in the ARP cache as well as the associated ELAN name.

By adding the optional “advanced” parameter, the VPI/VCI combination being used for each connection and any flags associated with each entry is displayed.

Notice that you can delete arp cache entries by specific MAC address.

LEC Default Configuration

```
myswitch::configuration lane lec default> ?
mode                    show

myswitch::configuration lane lec default> mode (manual | wellknown) [<LECS
address>]

myswitch::configuration lane lec default> show
  LEC Default configuration mode: wellknown
```

Core Switch

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This command allows the user to set the default mode for configuring all of the ELANs that may be created on this switch.

manual | wellknown - Choosing “manual” means that the LECS address specified here is used as the LECS address. The default option, “wellknown”, indicates that the ATM Forum’s well-known LECS address will be used.

LECS address - This address is the NSAP address for the LECS to be used instead of the well-known LECS address.

IP Configuration of Created LECs

```
myswitch::configuration ip> address el5 198.29.25.101
myswitch::configuration ip> admin el5 up
myswitch::configuration ip> show el5
interface   state   address          netmask          broadcast          mtu
el5         up      198.29.25.101    255.255.255.0    198.29.25.255      1516
```

Core Switch

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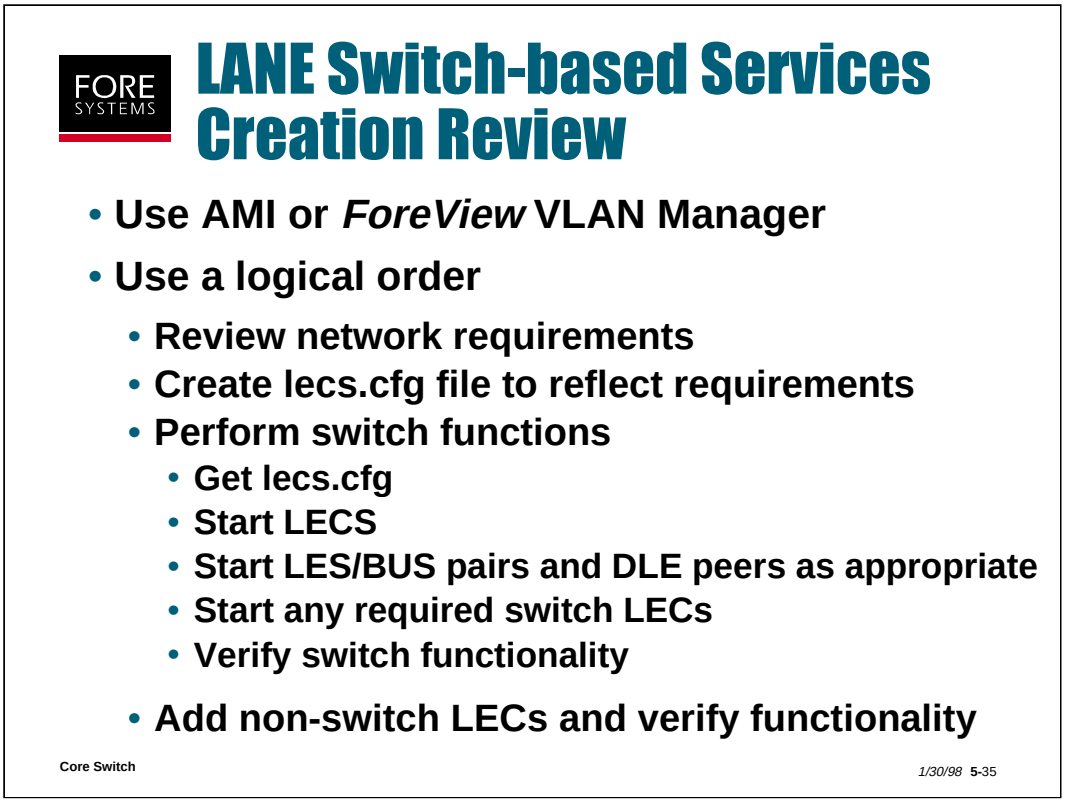
Each time you issue the “configuration lane lec new” command, a new LEC instance is created on the switch. In order for this LEC to operate on the ELAN, it must be given an IP address and enabled.

The “configuration ip address” command enables you to assign an IP address to the switch interfaces. In this case, we are configuring el5.

The “configuration ip admin” command enables that interface.

Remember, if you assign an ip address and mask as part of the “configuration lane lec new” command, this is all done automatically for you.

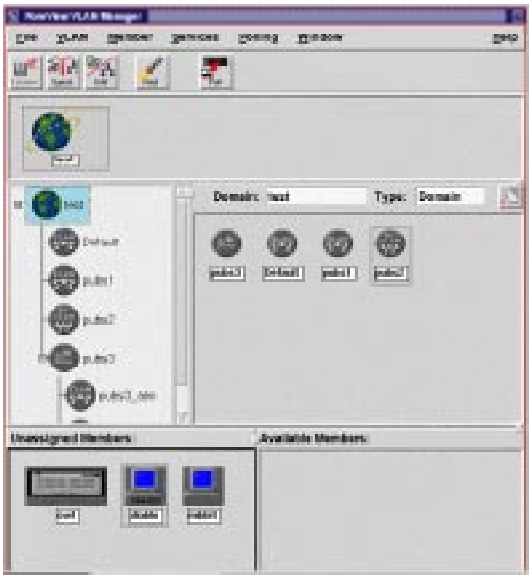


So far, we have shown how to create an lecs.cfg file, transferred the lecs.cfg file to the flash memory on the switch, started the LECS services on the switch, started LES/BUS services on the switch, started a LEC client instance on the switch, and configured that client with an IP address to make it able to be contacted.

Now we will perform all of those functions using VLAN manager and *ForeView*.

This section discusses LANE Services creation from a *ForeView* VLAN Manager perspective. This section will show VLAN Manager screens from the *ForeView* 4.2 release (although each version of VLAN Manager has offered similar ELAN functionality, this is the first release to enable VLAN, ELAN and Hybrid VLAN configuration capability).

VLAN Manager User Interface



Core Switch

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By running /usr/local/foreview/bin/fvlan on a Sun workstation or clicking on the FVLAN icon on a PC's ForeView Program Group, you are presented with the VLAN Manager's Main Window (as shown above).

This VLAN Manager User Interface is divided into three parts. The top section shows managed domains which have already been created (test in the example). The middle section shows the managed VLANs (pubs1 in the example) and their associated members. The bottom section shows managed machines (diablo in the example).

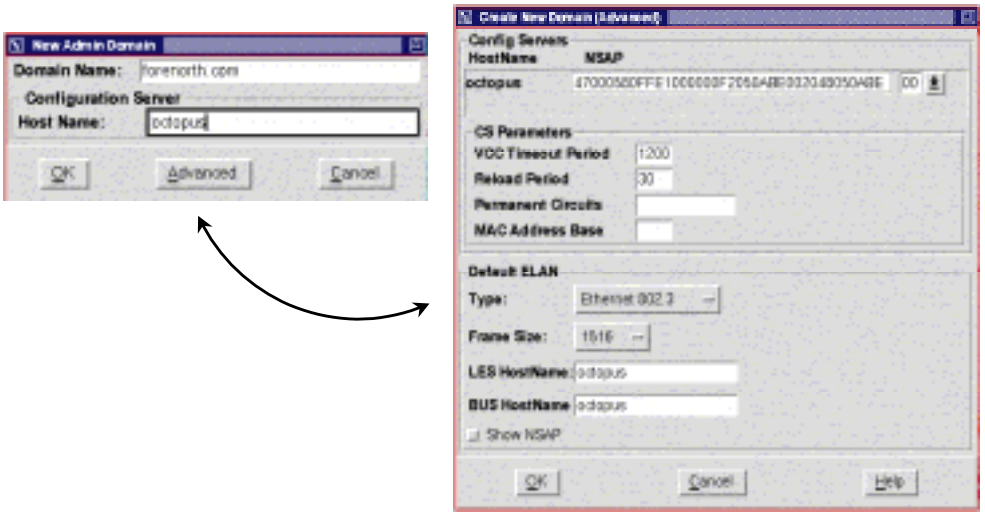
In ELAN speak, a domain = everything managed by one LECS (redundancy is supported). The color of the domain icon indicates status as follows: red = all servers down, yellow = some servers down, green = all servers up, blue = unknown (perhaps no LANE servers configured) and gray = edited state (meaning changes have been made but not yet committed).

Managed VLANS can be ELANs, VLANs or Hybrid VLANs.

The pull-down menu bar at the top of the main menu includes a File menu to control domains, a VLAN menu to control VLANs/ELANs, a Member menu to control members and a Services menu to control LANE services.

There is also an icon bar below the pull-down menu bar which includes an icon for committing changes (Commit), an icon for synchronizing the stored admin. domain configuration with any changes made to the network (Synch), an icon used to show the differences between the actual network configuration and VLAN manager's current view of the network (Diff), an icon used to find a VLAN, machine or host by name (Find) and an icon used to perform a demand poll of the network (Poll).

Creating Domains



Core Switch

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An administrative domain is a group of VLANs segregated by the fact in LANE that they are supervised by a unique configuration server (lecs.cfg file in ELAN speak).

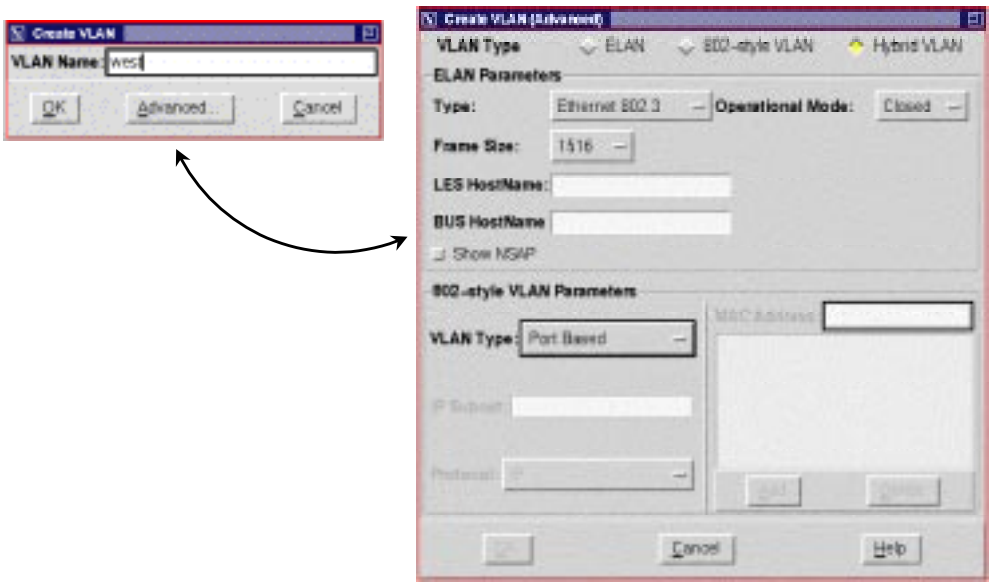
To create a new domain select “File Create Admin Domain” from the Main Menu VLAN Manager display.

You will be asked to name the domain (one per physical network, just like LECS) and the host name (or IP address) for the location/s where the configuration server is to be located. If LANE is not being used, leave the configuration server host name blank.

If you select the advanced button you will see the screen shown above on the right where you may select the selector byte for the LECS, adjust some default LECS parameters and even indicate the location where the default ELAN is to be created.

If you want to modify a domain after creation, there is a “File Modify Domain” selection on the Main Menu from which you can add redundant configuration server locations or adjust default or previously configured LECS parameters.

Creating ELANs



Core Switch

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Once a domain has been established, VLANs may be created. There are three types (802 style VLANs, ELANs or Hybrid VLANs) which indicate the type of clients supported.

The determination of which type of VLAN is created is made automatically as the first client (member) is added or may be pre-defined using the advanced button.

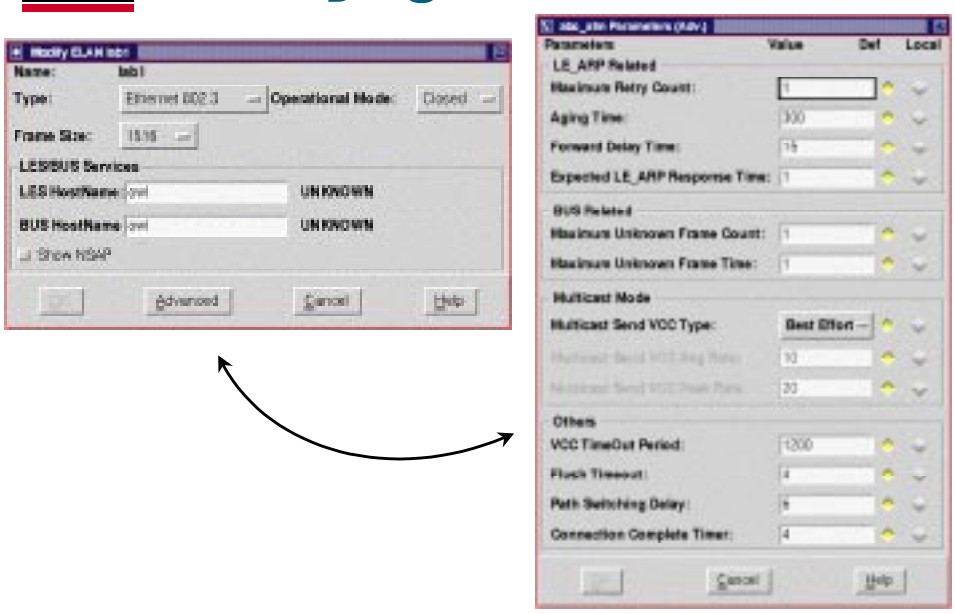
To create a VLAN select “VLAN Create” from the Main Menu and select the advanced button after typing in the VLAN name. The screen shown above on the right will be displayed.

Select which type of VLAN you want to create by pressing one of the buttons at the top of the screen. This will enable either the ELAN portion of the screen, the 802-style VLAN portion of the screen or both (if Hybrid is selected).

Enter the type of ELAN, its frame size and its LES and BUS server locations. You may let the NSAP selector byte be automatically selected or show and adjust it by selecting “Show NSAP”.

If 802-style VLAN or Hybrid was selected, select either “Port Based” or “MAC Address Based” as the client definition membership type.

Modifying ELANs



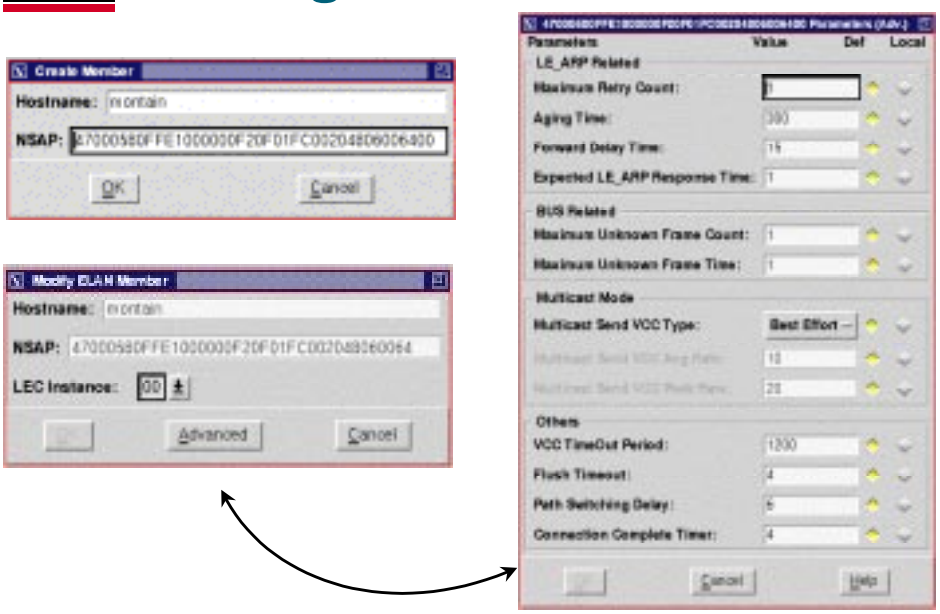
Core Switch

If after creating an ELAN, you decide to adjust some parameter, select “VLAN Modify” from the Main Menu and press the Advanced button to see the screen shown above on the right.

Notice that from this screen you can adjust LE_ARP parameters, BUS parameters, Multicast QoS parameters and Others.

The Def indicator shows if this value is a default value inherited from the lecs.cfg. The Local indicator tells you if this value applies only to this specific ELAN.

Adding ELAN Members



Core Switch

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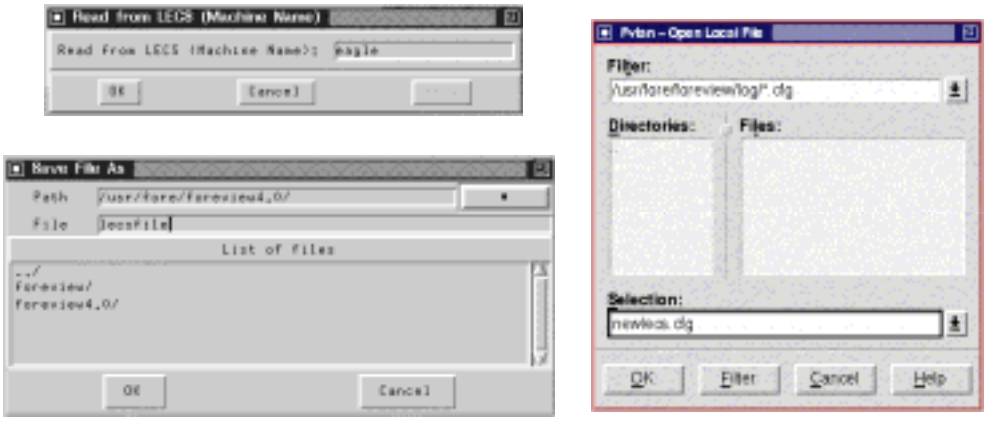
To create an ELAN member, select “Member Create” from the Main Menu. Enter the hostname (or IP address) of the machine being added. The VLAN Manager will query the machine for its NSAP address, or this value will have to added manually. When you select OK, this machine is added to the unassigned member area on the Main Menu. From there you can drag and drop the member onto any VLAN shown in the VLAN/Member area of the Main Menu.

If after creating an ELAN member, you decide to adjust some parameter, select “Member Modify” from the Main Menu and press the Advanced button to see the screen shown above on the right.

Notice that from this screen you can adjust LE_ARP parameters, BUS parameters, Multicast QoS parameters and Others for this particular client.

The Def indicator shows if this value is a default value inherited from the lecs.cfg. The Local indicator tells you if this value applies only to this specific ELAN client.

LECS Operations



Core Switch

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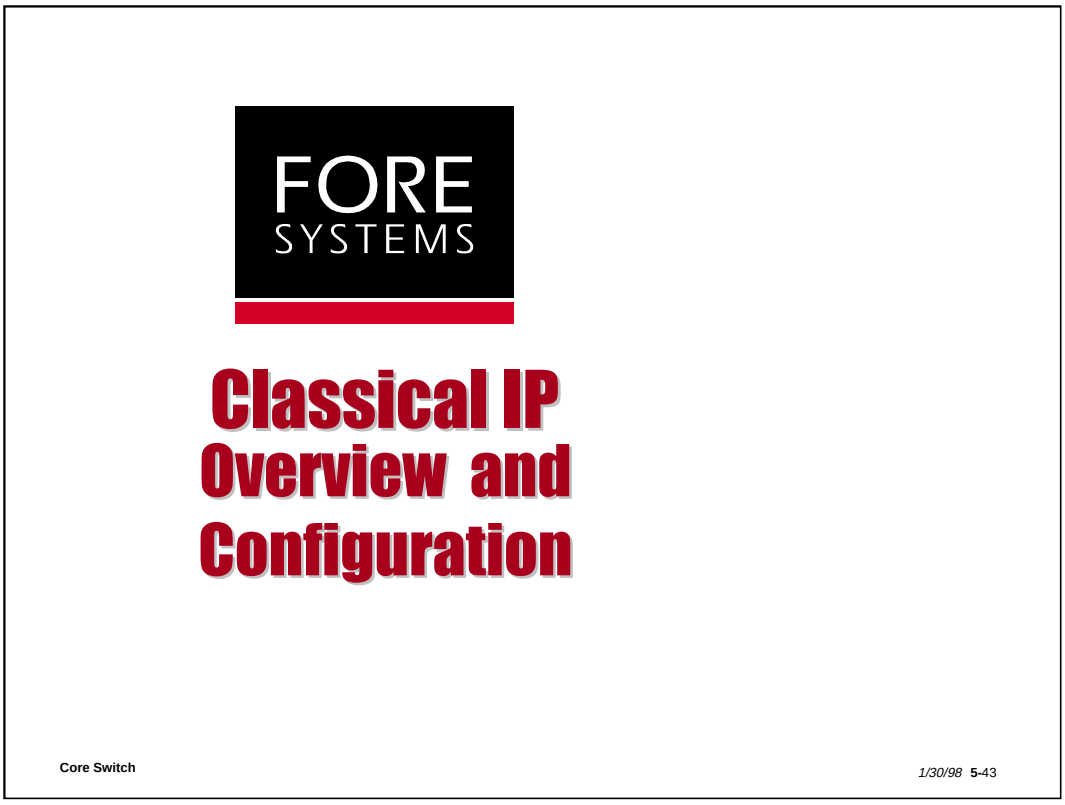
Before performing any LECS operations, it is important to note that all releases of VLAN Manager prior to release 4.2 are incompatible with release 4.2 because release 4.2 utilizes 40 character NSAP addresses for each client instead of 12 character MAC addresses. So, prior to doing any of the steps below, make copies of any existing lecs.cfg files and print the contents out if possible.

To retrieve a configuration file (lecs.cfg) select “File Retrieve config from LECS” from the Main Menu and type in the machine name (IP address) of the location for the lecs.cfg. If it is an older version you may get the prompt “The file on <lecs-host-name> is an older version. It needs to be converted to the current version. Refer to the user manual for information on converting the file to new format.”

To create a local backup of the lecs.cfg select “File Local Backup/Save as” from the Main Menu. Type in the path to use and the file name.

To open a locally saved and edited lecs.cfg, select “File Local Backup/Open” from the Main Menu. This screen allows you to modify the path and name of the locally stored configuration file.



Classical IP is the second form of LAN data over ATM support presented in this module.

Although it has been around for some time, it has not changed functionally since its initial release, and continues to offer the same disadvantages, while other applications (such as LANE) have improved over time.

Classical IP Overview

- **RFC-1577 contains the rules**
- **IP only / unicast only / arpserver required**
- **MTU size up to 65,535 bytes (9,180 default)**
- **IP encapsulation per RFC-1483 (Sec. 4.1)**
- **Four virtual interfaces per switch fabric (Qaa 0-3)**
- **Clients join LISs (each with unique subnet address)**
- **Must route between LISs**
- **SVC operation based on ATM-F UNI signaling and ILMI NSAP address registration**

Core Switch

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Unlike LANE, Classical IP is defined by the IETF through RFC- 1577 and addresses IP LAN data over ATM only.

Notice that today it is unicast only, and all communications are established with the help of an ARP server.

FORE supports 4 virtual interfaces for Classical IP on any switch, and they are defined as qaa0-3.

To communicate between Logical IP Subnets (LISs) which interfaces may be members of, you must route.

Notice, just like LANE, Classical IP is an SVC based service which utilizes ATM forum UNI signaling to NSAP ATM addresses registered over ILMI.

Classical IP Switch Configuration - AMI

```
myswitch::configuration atmarp> getnsap qaa0
qaa0 NSAP address: 47000580ffe1000000f21a00de0020481900de00

myswitch::configuration atmarp arpserver> set 47000580ffe1000000f21a
00de0020481900de00 qaa0

myswitch::configuration atmarp arpserver> show qaa0
Interface   ARP Server Addr                                        Enabled
qaa0        Ox47.0005.80.ffe100.0000.f21a.00de.0020481900de.00    Yes

myswitch::configuration ip> address qaa0 198.29.22.1

myswitch::configuration ip> admin qaa0 up

myswitch::configuration ip> show qaa0
interface   state    address        netmask        broadcast        mtu
qaa0        up       198.29.22.1    255.255.255.0  N/A              9180
```

Core Switch

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Classical IP networks consist of an ARP server entity, and clients who register with the ARP server to become members of a virtual subnet.

Using AMI commands on the switch, you can create the ARP server and create clients. As will be shown on the next slide, *ForeView* allows only client creation.

To determine the NSAP address of the switch you are managing with AMI, run the command “conf atmarp getnsap” as shown above.

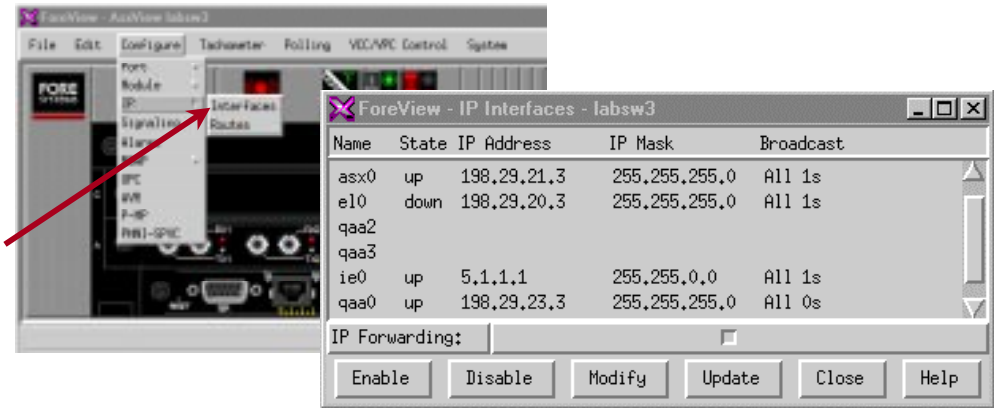
To make the switch an ARP server, run the AMI command “conf atmarp arpserver set” as shown above. Use the “show” sub-command to prove the ARP server is functional.

To create Classical IP clients on the switch, use the AMI command “conf ip add” and “conf ip admin” for the qaax interface created. Use the “show” sub-command to prove the client was created successfully.

Use directed pings (remember no broadcasting is supported) to prove connectivity between clients (i.e. switch to host).

Classical IP Switch Configuration - *ForeView*

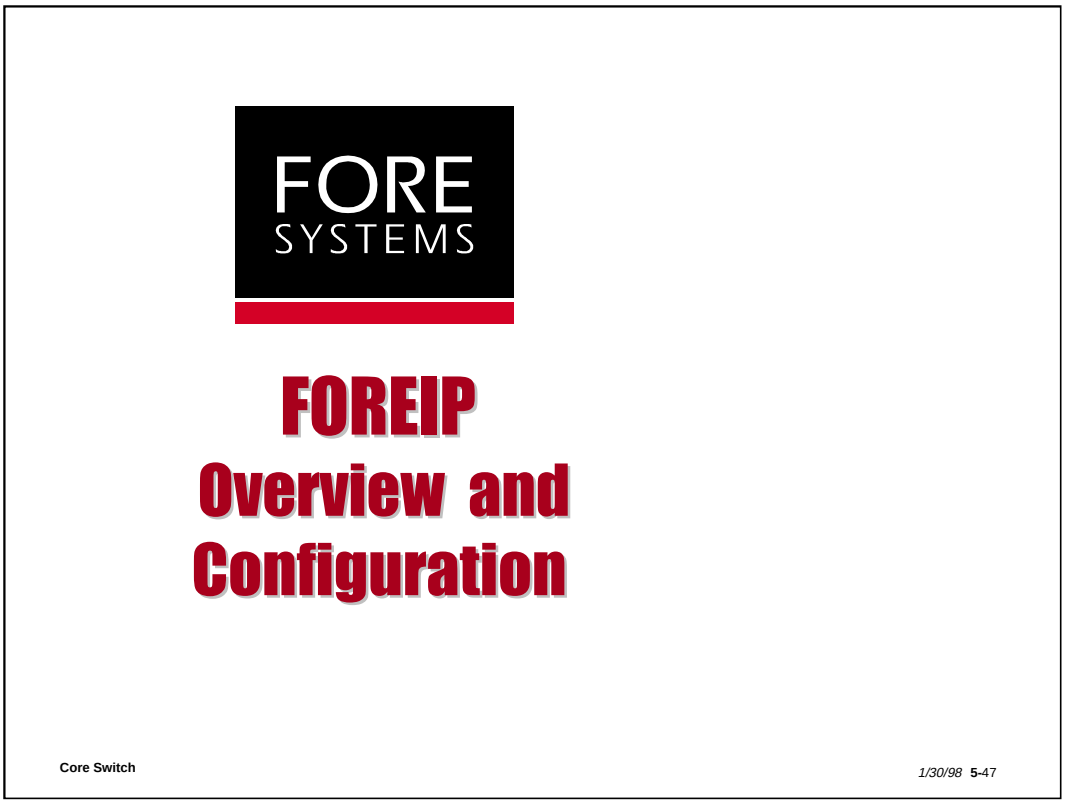
- **Select Configure IP Interfaces to configure the switch's qaa0-3 interface addresses**
- **No Arpserver functionality available**



Classical IP configuration with *ForeView* is limited to client creation.

From the Front Panel display, select Configure IP Interfaces, and use the IP interface screen to then configure qaa0-3 interfaces.

Since ARP server creation requires an AMI session, you could open a session from the File pull-down menu on the Front Panel display and perform the steps listed in the previous slide.



FOREIP was at one point in time the only method available for moving LAN data over ATM.

Although its functionality has not changed significantly over time, it is only very recently that standards-based support has been made available which duplicates all of the features inherent in an original FOREIP/SPANS network environment.

FOREIP Overview

- **IP only / Broadcast/Multicast supported using Connectionless Server**
- **MTU size up to 65,535 (9,188 bytes default)**
- **IP encapsulation per RFC-1483 (Sec. 5)**
- **Only one virtual interface per switch fabric (asx0)**
- **Clients all join one subnet**
- **SVC operation based on SPANS signaling and CLS SPANS address registration**

Core Switch

1/30/98 **5-**48

FOREIP was introduced in the 1992 time frame, as a prestandard solution for moving LAN data (specifically IP) over ATM.

Although an IP only solution (like Classical IP), it fully supported broadcast and multicast operations (unlike Classical IP).

FOREIP supports only one virtual interface.

SVC connections are made utilizing SPANS signaling to other SPANS addresses which are registered over the CLS channel.

FOREIP Switch Configuration - AMI

```
myswitch::configuration ip> address asx0 198.29.21.1

myswitch::configuration ip> admin asx0 up

myswitch::configuration ip> show asx0
interface   state    address         netmask         broadcast          mtu
asx0        up       198.29.21.1     255.255.255.0   198.29.21.255      9188

myswitch::configuration atmarp> show
IPaddress        If      VPI   VCI   AAL    Type          Direction
198.29.21.156    asx0    0     63    aal5   foreIpSVC     outgoing
IPaddress        If      NSAP Address
198.29.22.156    qaa0    0x47.0005.80.ffe100.0000.f21a.00de.0020481a0138.00
```

Core Switch

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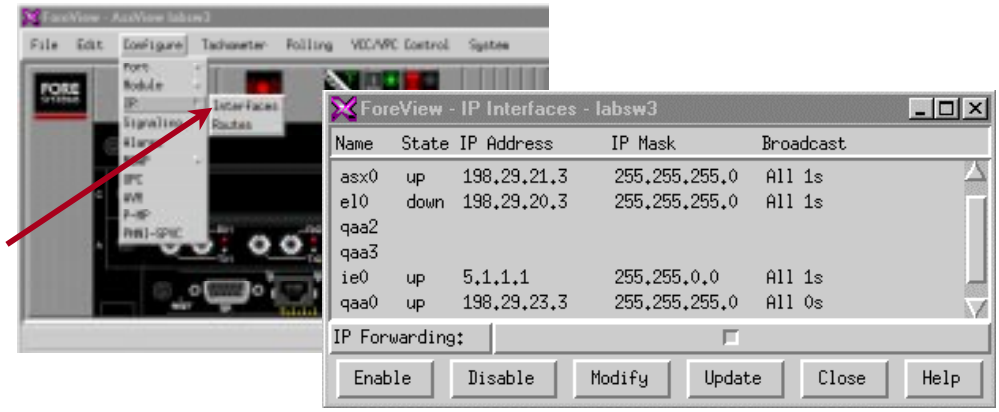
To configure FOREIP on our switches using AMI commands, one needs to simply turn on the power, and assign an IP address to the asx0 interface as shown above.

To view FOREIP (or Classical IP) ARP cache entries, use the AMI command “conf atmarp” as shown above.

FOREIP Switch Configuration - *ForeView*

- **Select Configure IP Interfaces to configure the switch's asx0 interface address**



FOREIP configuration with *ForeView* requires only asx0 interface IP address creation.

From the Front Panel display, select Configure IP Interfaces, and use the IP interface screen to then configure the asx0 interface.

SVC Network Connections Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

_____

1. The ATM Forum LANE standard allows for the use of which of the following MTU (maximum transmission unit) sizes:

   a. 1516 bytes

   b. 18,190 bytes

   c. 65,535 bytes

   d. a and b

   e. b, and c

2. In the LECS configuration file, a missing “group” implies that the “key” and “value” apply only to the next emulated LAN listed. True / False

3. LECS configuration file accept and reject rules consist of the following four types:
   _____ _____

   _____ _____

4. When configuring DLE peers, you only have to enter the NSAPs of other devices and **not** your own. True/False

5. The “configuration lane les show <index> advanced” AMI command provides the following information about a LES on the switch:

   a. control distribute connections the LES maintains to each LEC

   b. LES and BUS NSAP addresses

   c. MAC to NSAP address mapping for each LEC in the ELAN and whether or not it is a proxy

   d. point-to-point connections the LES maintains to each LEC

   e. all of the above

6. The information concerning a colocated bus is displayed under the “configuration lane bus show” menu. True / False.

SVC Network Connections Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

_____

7. Which of the following statements is true of Classical IP over ATM:
   a. Classical IP over ATM is defined by the IETF in RFC-1577
   b. Classical IP over ATM has no broadcast or multicast capability
   c. Classical IP over ATM employs SPANS UNI signaling and ILMI NSAP address registration
   d. The default MTU size for FORE's CLIP interface is 9,180 bytes
   e. a, b, and d above

8. When configuring the FORE switch using ForeView, ARP Server creation is done from the "Configure" pull-down menu on the Front Panel View. True / False

9. Match the data over ATM application on the left with the proper feature listed on the right (indicate all that apply)

LANE_____	a. IP supported only
CLIP_____	b. Multi-protocol
FOREIP_____	c. Broadcast/Multicast supported
	d. Standards-based Signaling
	e. Uses ILMI for Address Registration

10. The VLAN Manager supplied with ForeView 4.2 is able to change the LE_ARP Cache aging time for a particular ELAN. True / False

SVC Network Connections (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. The ATM Forum LANE standard allows for the use of which of the following MTU (maximum transmission unit) sizes:
   a. 1516 bytes
   b. 18,190 bytes
   c. 65,535 bytes
   d. **a and b**
   e. b, and c

2. In the LECS configuration file, a missing "group" implies that the "key" and "value" apply only to the next emulated LAN listed. True / **False**

3. LECS configuration file accept and reject rules consist of the following four types:
   MAC Address **NSAP Address**
   NSAP + Equal Length Bit Mask **NSAP with embedded 'X' don't cares**

4. When configuring DLE peers, you only have to enter the NSAPs of other devices and **not** your own. True/**False**

5. The "configuration lane les show <index> advanced" AMI command provides the following information about a LES on the switch:
   a. control distribute connections the LES maintains to each LEC
   b. LES and BUS NSAP addresses
   c. MAC to NSAP address mapping for each LEC in the ELAN and whether or not it is a proxy
   d. point-to-point connections the LES maintains to each LEC
   e. **all of the above**

6. The information concerning a colocated bus is displayed under the "configuration lane bus show" menu. True / **False**.

SVC Network Connections (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

7. Which of the following statements is true of Classical IP over ATM:
   a. Classical IP over ATM is defined by the IETF in RFC-1577
   b. Classical IP over ATM has no broadcast or multicast capability
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   d. The default MTU size for FORE's CLIP interface is 9,180 bytes
   e. **a, b, and d above**

8. When configuring the FORE switch using ForeView, ARP Server creation is done from the "Configure" pull-down menu on the Front Panel View. True / **False**

9. Match the data over ATM application on the left with the proper feature listed on the right (indicate all that apply)

LANE___**b c d e**_____	a. IP supported only
CLIP_____**a d e**_____	b. Multi-protocol
FOREIP___**a c**_____	c. Broadcast/Multicast supported
	d. Standards-based Signaling
	e. Uses ILMI for Address Registration

10. The VLAN Manager supplied with ForeView 4.2 is able to change the LE_ARP Cache aging time for a particular ELAN. **True** / False

Module 6
Network Troubleshooting

Problem Isolation

- **In a multi-switch environment, first determine if the problem affects one switch, a connected pair of switches, all switches related to one or more connections or all switches.**
- **Depending on the outcome of the above step, troubleshoot the switch, the NNI link, the connection (VPI/VCI) or the application (LANE services or Classical IP ARP server).**

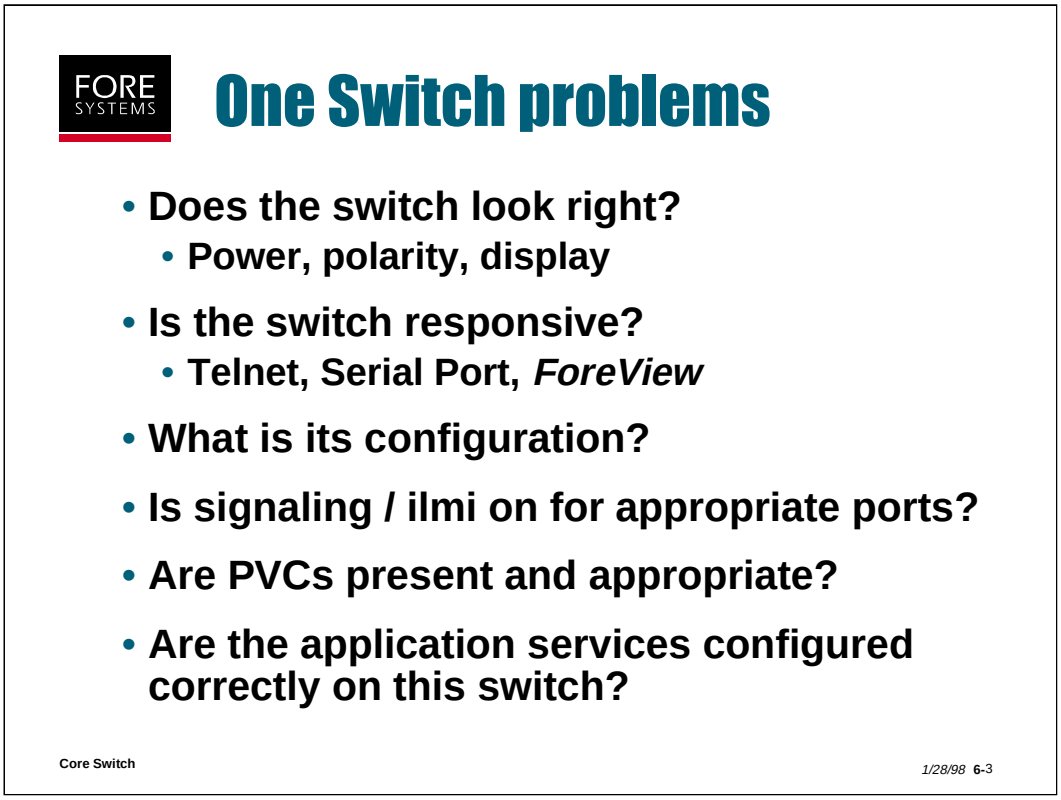
Core Switch

1/28/98 **6-**2

In any multi-product (in this case, ATM switch) network, the first troubleshooting step is to ascertain the extent of the problem. Does the problem seem to be affecting only one switch, a pair of connected switches, all switches involved in the support of one end- to-end connection, or all switches?

This first step will dictate the approach used to troubleshoot. If that approach is followed to the end it will either solve the problem or lead to the discovery of a more extensive problem. In either case, these are positive corrective actions.

The following slides review each of these possible approaches.



For one switch problems (those affecting only one switch in the network), the approach is to focus only on that one switch from a logical physical-to-application progression.

First, just look at the switch. Are there any lights on? Are there any red lights on? Remember, our LAN port LED indicators are out when polarity is correct and when the switch is powered off. Are the power supply lights on and green? Remember, only one has to be on and green for BXs and 1000s. Is the display indicating the name of the switch? Some people create a name longer than the display so that it must constantly scroll. Is it scrolling? If not, what does it say? If it flashes Bootp over and over, it means the operating system can't be found and it is looking for a new one on its Ethernet interface.

Can you access the switch using any management technique? If you can, look at "conf sw sh" using AMI or click on the FORE logo on the Front Panel display in *ForeView* to see if you can find out which revision of hardware, firmware and software is running.

Use "conf spans sh or conf sig sh" under AMI or look at the color of the port status bars under *ForeView* to determine if the appropriate signaling type is active and address registration has taken place for the device attached to the port.

Use "conf vpc sh, conf vpt sh and conf vcc sh" under AMI or PVP/VPC control under *ForeView* to determine whether any PVCs are present and potentially causing problems for your connection creation process.

Lastly, if you are running LANE or Classical IP, this switch may not be configured correctly for the application. Perhaps its NSAP address was incorrectly entered into an lecs.cfg file, or it is not part of the Classical IP subnet, etc.

Connected Pair of Switches Problems

- **If a pair of connected switches are exhibiting the problem look at:**
  - **the physical link polarity between switches**
  - **any loopbacks on the physical link**
  - **Path 0 status on the link between switches**
  - **Appropriate use of alternate paths and channels on the link**
  - **Port problems at one end of the link**

Core Switch

1/28/98 **6-**4

For problems related to a pair of connected switches, the approach is to focus on the link between the switches.

First, look at the port LED indicators for the interconnecting link. Are the polarity indications correct?

Next, access “conf port sh” under AMI or the Port Control screen under *ForeView* to determine if the interconnecting link port on either end is in loopback.

Is path 0 required on the link (signaling) for the application you are running, and if so, is it enabled and the proper signaling up? Use “conf spans sh or conf sig sh” under AMI or look at the color of the port status bars under *ForeView* to determine if the appropriate signaling type is active and address registration has taken place for the device attached to the port. Is the *ForeView* NNI symbol showing up on the interconnecting ports Front Panel view?

If you are using an alternate path between switches, is that path configured correctly and is signaling required for that path on the link for the application you are running, and if so, is it enabled?

Lastly, insure that the interconnecting ports on either end of the link are configured correctly.

All Switches Related to a Connection Problem

- **If the problem only seems to be related to a single end-to-end connection, but over every switch that connection traverses, look for:**
  - **A good connection traversing the same switches to be used for comparison**
  - **Problems related to host IP addressing or VPI/VCI addressing (switch or host)**
  - **Problems related to UPC/AV parameters**
  - **Application related problems**

To troubleshoot a connection related problem, where a connection cannot be made or is broken between two end points in a multi-switch environment, first try to find a good connection to compare against.

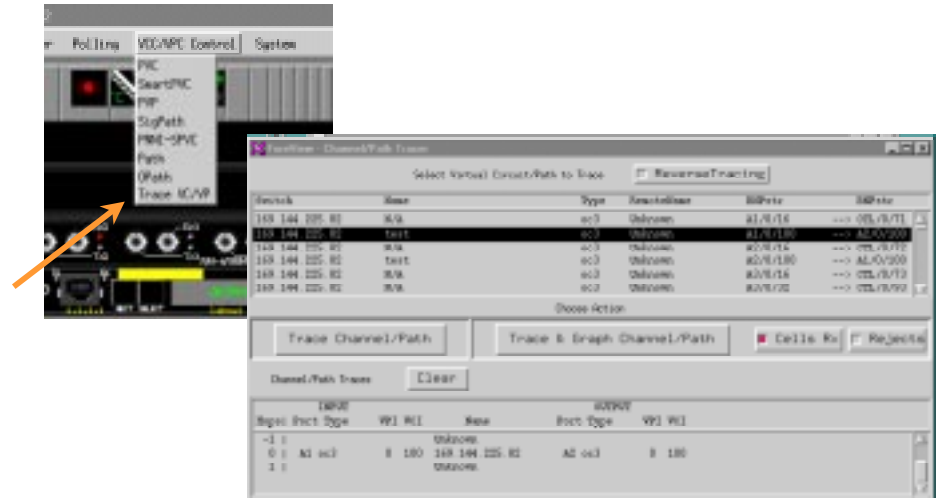
In some cases it is easiest to start at one end of a connection and verify link-by-link in a uni-directional fashion. This can be done using “conf vcc sh” under AMI for each link or the channel trace tool under *ForeView* (shown on the next slide).

Another place to look is addressing. If this is a PVC connection, VPI/VCI addressing may have been typed incorrectly for one of the links in the connection, or incorrect IP addressing applied to one end of the connection. Again, the channel trace tool of *ForeView* is a very valuable tool to determine this.

If the connection has a UPC contract or nsap filtering rules applied to it, there is a possibility that the parameters defined are not robust enough to allow the application to operate. In this case, try removing the contract or rules or try increasing the UPC values.

Many single connection problems are related to the application itself, such as, ILMI off on a link or device requiring signaling, pointing to the wrong ARP server NSAP address, or incorrect application of accept and/or reject statements in the lecs.cfg.

The *ForeView* Channel Trace Tool



Core Switch

To perform a channel trace with *ForeView*, select Trace VP/VC from the Front Panel display “Control VPC/VCC” pull-down menu.

The Trace screen shown above on the right is displayed showing all end point addresses in this network. Select an end point to start tracing from, and then select either to trace the connection, or trace and graph the connection.

The area at the bottom of the trace screen will show a link by link connection status of this end-to-end connection.

All Switches Problem

- **If the problem seems to be present on all switches in the network, look to:**
  - **Application level configuration**
    - **Incorrect ARP Server or LES NSAP address**
    - **Incorrect stand-alone BUS NSAP address**
    - **lecs.cfg configuration errors (accept/reject at switch type level)**
  - **Software feature set support**
    - **Application not supported on this release**

Core Switch

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If your problem seems to be present on all switches (or all hosts on all switches), it is most likely related to the application that you are attempting to run on the network.

For instance, if the real NSAP address of the ARP server or LES is different from that which was configured originally (i.e. replaced ATM card in host or SCP in switch acting as ARP server or LES), or the stand-alone BUS NSAP address was incorrectly entered.

Also, lecs.cfg problems related to ATM network parameters (affecting all ELANs) or accept/reject rules problems at the switch type level (i.e. accept one NSAP of a particular switch type says to reject all other NSAPs of that switch type).

Finally, it is possible, however unlikely, that someone would try to run an application on products which do not support that application in the release of software running on the product (i.e. LANE 1.0 support on a 3.x release of FT software).

Troubleshooting Configuration

- **Establish a confined troubleshooting area (switch, pair of switches, end-to-end connection, etc.)**
- **Insure your “area” is safe for possible re-configuration**
- **Troubleshoot just that “area” completely before expanding scope**
- **Do not hesitate to change connection types (SVC to PVC) if possible**
- **Establish a known traffic source/sink**

Core Switch

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For network troubleshooting in general, it is imperative to first limit your scope of problem solving. Establish a confined test area and then test that area fully, before moving to other or larger areas. Record you original test setup and steps that were taken (plus results).

Remember that ATM is connection oriented and that information will not pass without a connection being established first. Also remember that PVC connections, although cumbersome, are also able to be used to test devices, interfaces, links, addressing, etc.

One of the most important steps is to establish what you are going to use as your traffic source to prove that a connection was made (i.e. directed ping, broadcast ping, meaty ping, resident program, ELAN join request, etc.), and what you are going to use to monitor success (i.e. ping response, elconfig show -configured, atm statistics gathering, etc.).

Debug Commands

```
myswitch::debug>?
        dump>           mode            trace>

myswitch::debug>mode
debug mode is set to novice

myswitch::debug dump>cdb size
                        ***** WARNING *****
Debug commands nay have negative effects on the switch software.
Dump commands pause the switch control software for their duration,
may have many pages of output, and cannot be stopped mid-execution.
Various trace commands can overload the switch with syslog messages.
You can turn off this warning with: “debug mode wizard”
Execute the debug command [n]? y

CDB size = 7998 bytes
```


The “debug” commands are normally used after a problem has been encountered on a switch or in a network.

The “mode” can be set to novice or wizard, and the difference is mainly in the amount of dialog presented to you when running the commands (an example of the novice script is shown above). In wizard mode the command would have been executed without the warning.

Besides “mode”, the other two debug options are “dump” and “trace”. “Trace” is utilized to turn on or off collection of information and “dump” is used to display the information collected.

Details of all the debug commands are found in the *ForeRunner* ATM Switch Diagnostics and Troubleshooting Manual.

Statistics Gathering

- ATM statistics can be gathered for switching products using AMI or *ForeView*
  - AMI statistics include board, module, port, signaling, connection and OAM
  - *ForeView* statistics include above plus the ability to Graph or Log
- Remember to establish a known good source of information prior to statistics gathering

Statistics (board/module) - AMI

```
myswitch::statistics> ?
aal0                aal4                aal5                atm
atmroute>           board               cec>                cese1
cesds1              ces                 cr                  ctlport
icmp                interface           ip                  ipaccess
module              nsapfilter>         oam>                port
spans               tcp                 udp                 signalling
vcc                 vpc                 vpt

myswitch::statistics>board
Board        VPI-Lookup-Errors                VCI-Lookup-Errors
1                         1241                              562

myswitch::statistics>module 1A
Module  Priority    Status      Size    Qlength  Overflows
1A      0           enabled      512          0          0
1A      1           enabled      512          0          0

myswitch::statistics>module traffic 2B
Module   Model   Ucasts   Mcasts   Mouts   Cells   Shared     Used
2B           2       30        1       6       0     7392        4
```

Core Switch

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Statistics may be gathered for a large number of items using the “statistics” AMI command.

You may gather statistics related to the ATM layered model (i.e. aalx, atm and physical layers).

You may gather statistics related to virtual connections (i.e. vcc, vpc and vpt).

You may gather statistics related to signaling.

You may gather statistics related to the IP stack running on the switch fabric (i.e. icmp, interface, ip, tcp or udp).

Or, as in the case of installation, configuration and troubleshooting you may gather statistics related to the switch product itself (i.e. board, module as shown above and port as shown on the next slide). Note that the Circuit Emulation service/port information is separate from the rest of the port information.

Statistics (port) - AMI

```
myswitch::statistics>port
        Input                Output                    Cells       Cells
Port  VPs  VCs    BW   VPs  VCs    BW          Received Transmitted ErrSecs Overflows
1A1     1    6  0.8K     1    6  0.0K                 0      742025       0         0
1A2     1    6  0.8K     1    6  0.0K                 0      742025       0         0
1CTL    1   12  0.0K     1   14  0.0K           2756927     1283307       0         0

myswitch::statistics>port sonet
sonet   Port   1D1   Counter                    Value                Delta
sonetSectionBIPs                        1571776380               863766
sonetSectionLOSs                             32745                   18
sonetSectionLOFs                             32745                   18
sonetLineBIPs                                    0                    0
sonetLineFEBEs                                   0                    0
sonetLineAISs                                32745                   18
sonetLineRDIs                                    0                    0
sonetPathBIPs                                    0                    0
sonetPathFEBEs                                   0                    0
sonetPathLOPs                                    0                    0
sonetPathAISs                                32745                   18
sonetPathRDIs                                32745                   18
Press return for more, q to quit:
```

Core Switch

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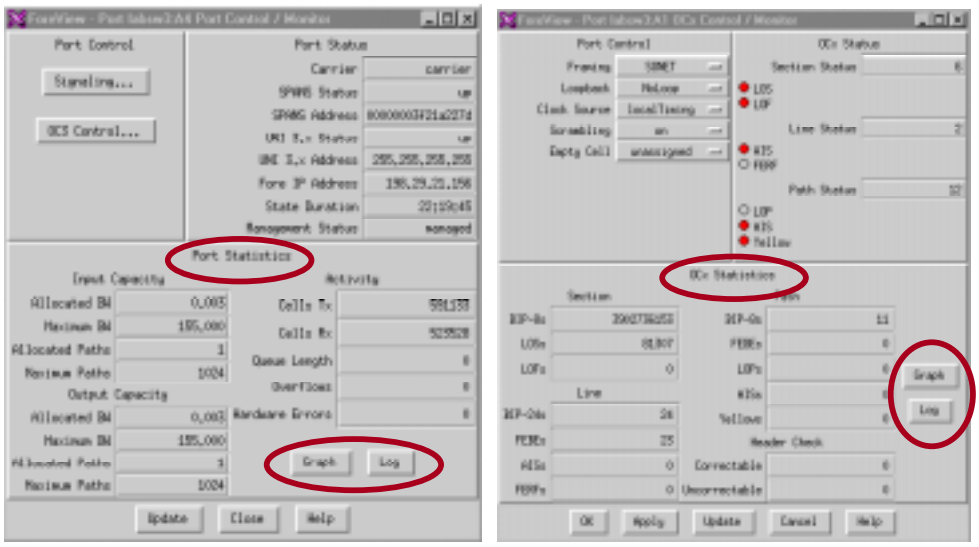
Overall port statistics can be obtained by typing the AMI command “statistics port”.

To get more specific statistics related to a particular port type, type the AMI command “statistics port <port type>“. In the example above, sonet specific information is presented, such as Section, Line and Path information.

Statistics (port) - *ForeView*



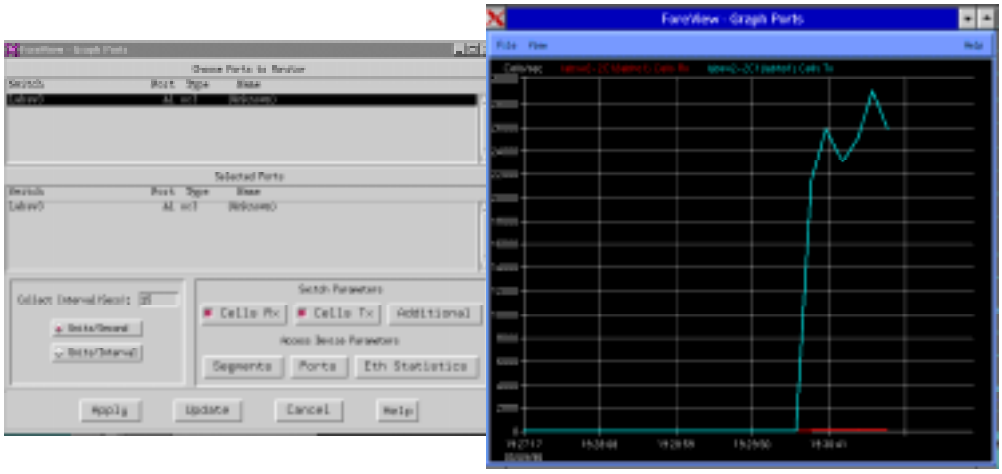
Notice that Port related *ForeView* statistics are collected on the Port Control screen and on the Media Control screen.

Notice also that there is a Graph and a Log button on each of these screens to allow graphing or logging of the statistical data.

These features are shown on the next two slides.

Port Graphing - *ForeView*

- **The Graph dialog box will yield the graph.**



Core Switch

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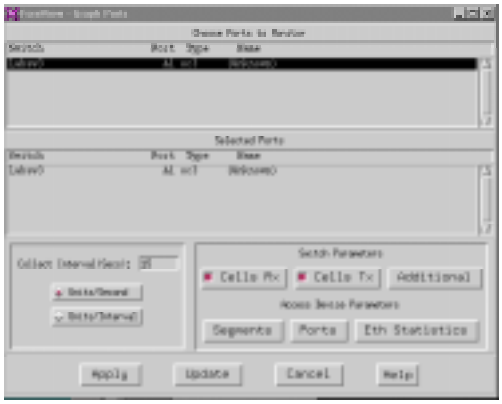
When you select Graph from the Port Control screen, the Graph Tool dialog box appears, which allows you to select which items will be graphed.

Port Logging - *ForeView*

- **The logging dialog box is very similar to the graphing box.**



Core Switch

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When you select Log from the Port Control screen, the Logging dialog box appears, which allows you to select which items will be logged and the logging interval.

All logged items will be stored as comma-delimited text files in the foreview directory under /log/fvlog.1.

Statistics (signaling) - AMI

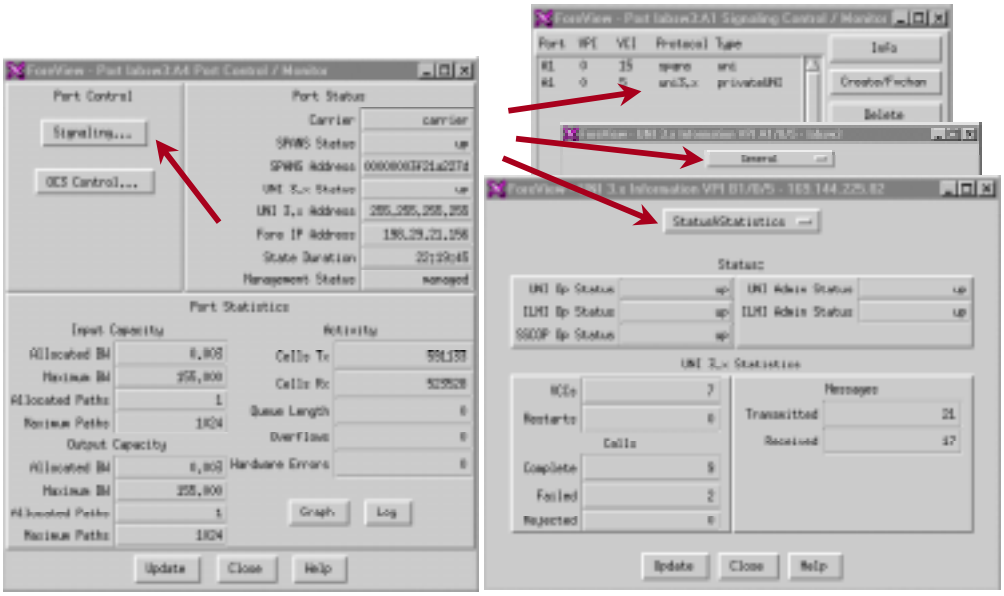
```
myswitch::statistics> signalling
Port   4A1   Counter                              Value              Delta
------------------------------------------ -------------------------------- ----------------------------
q2931VCCs                                             0                  0
q2931Restarts                                         0                  0
q2931CallsCompletions                                 0                  0
q2931CallsFailures                                    0                  0
q2931CallsRejections                                  0                  0
q2931TransmittedMessages                              0                  0
q2931ReceivedMessages                                 0                  0
Press return for more, q to quit: q

myswitch::statistics nsapfilter>calls
Port   VPI   Direction    Accept   Reject   Unmatched
------ ----- ------------ -------- -------- -------------------------
4A3     0    incoming        0        0               0
4A3     0    outgoing        0        0               0
```

Core Switch 1/28/98 **6**-16

To display signaling (UNI in the above example) statistics for a particular fabric using AMI commands, simply type “statistics spans or signalling” as shown above. The display shows you the “value” in the counter for each specific item, and the “delta” to that value since you checked it last.

Notice also that you can gather nsap address filter statistics for the individual port/path entities.

Statistics (signaling) - *ForeView*



Core Switch

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Signaling statistics in *ForeView* are obtained by selecting “Signaling” from the Port Control screen shown above on the left. This brings up the Signaling Control screen shown above (upper right). By selecting the type of signaling you want information about, and clicking the upper right info button you are taken to the Signaling Information screen. By selecting “Status & Statistics” from the button at the top, you will see the Signaling Status and Statistics information.

Statistics (connection) - AMI

```
myswitch::statistics> vpt [fabric] [<port> [<vpi>] ]
myswitch::statistics> vpt 2a4
Input       Output          Failures
Port  VPI   Port  VPI       CAC     VCI     Setup
2A4     0   terminate         0       0         0
originate   2A4     0         0       0         0

myswitch::statistics> vpc [traffic] [<port> [<vpi>] ]
myswitch::statistics> vpc traffic 1a1
Input       Output      CellsTx         CellsLost
Port  VPI   Port  VPI   CLP0   CLP1   EPD  CLP0+1   CLP1   Unintent   Intent
1A1     1   1A2     1      0      0   N/A       0      0          0      N/A
1A1     2   1A3     2      0      0   N/A       0      0          0      N/A

myswitch::statistics> vcc [traffic] [<port> [<vpi> [<vci>] ] ]
myswitch::statistics> vcc 1a1  0 15
Input             Output                          Cells      Cells
Port  VPI  VCI    Port  VPI  VCI   Uptime       Received   Rejected
1A1     0   15    1CTL    0   32   0d:03:22        67821          0
```

Core Switch

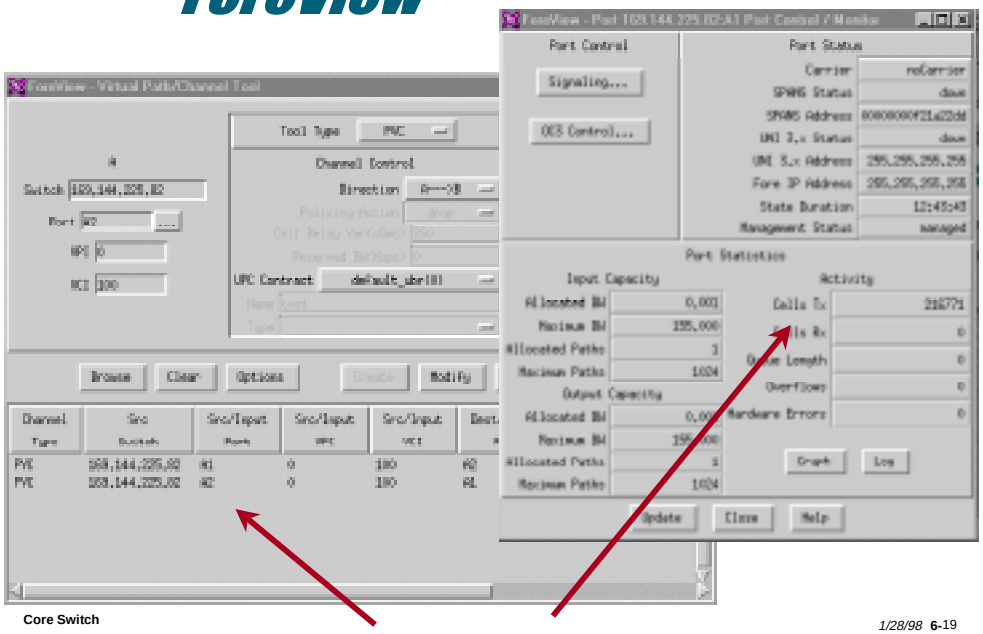
Statistics may be gathered on a connection basis for VPT, VPC and VCC type connections, per fabric or individually.

VPT statistics are collected per fabric / port / path / direction, and indicate Call Admission Control failures (not enough bandwidth), VCI failures (VCI already in use, out of range or not enough VCIs on this path) and Setup failures (output netmod cannot support this connection).

VPC statistics are collected per port / through path and may be displayed as cells received/rejected (similar to VCC display above) or as path traffic statistics indicating Cells Lost (cells on this path dropped by output netmod), CellsLostIntent (cells on this path for LC or D netmods only dropped due to EPD), CellsLostUnintent (cells on this path for LC or D netmods only dropped due to CLP or output memory shortages) and the number of cells transmitted on this path. Series D netmods can also show CLP0 vs. CLP1 traffic or Cells vs. Packets sent, and CLP0+1 and CLP1 cells lost.

VCC statistics are collected per port / path / channel and may be displayed as cells received/rejected or as channel traffic statistics indicating Cells Lost, CellsLostIntent, CellsLostUnintent and the number of cells transmitted on this channel (for LC and D netmods). Series D netmods can also show CLP0 vs. CLP1 traffic or Cells vs. Packets sent, and CLP0+1 and CLP1 cells lost.

Statistics (connection) - *ForeView*



Core Switch

Connection statistics within *ForeView* are displayed in two areas.

If you select a particular type of connection under “Control VPC/VCC” on the Front Panel display, you will be taken to that type of connection’s channel tool (VPC is shown above on the left).

When you browse that connection type, information is displayed showing all connections of that type, including uptime.

Also, information such as transmitted cell counts and errors associated with cell movement can be found as part of the port status screen (right click on a selected port).

Working With TAC

- **TAC may be called at any point in your troubleshooting procedure but…**
  - **First try to collect as much information about the problem as possible**
  - **Try to duplicate the problem at least once**
- **Then call (800) 671-FORE (3673) or fax questions to 724-742-7900 or send email to support@fore.com**
- **Or…use TAClink (part of *ForeView*) to send error log file or stack trace to TAC**

Core Switch

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TAC may be called, faxed, emailed or written anytime you encounter a problem with FORE equipment, but it will help both parties if some information collection is done first.

As part of *ForeView*, we also offer TAClink, which is an automated way to inform TAC of a problem encountered by *ForeView* at your site.

The following slide shows the TAClink screen and explains how it is used.

ForeView TACLink

- **Auto/manual retrieval of critical network information**
- **Automatically e-mailed to FORE's Technical Assistance Center (TAC)**
- **Simplifies and speeds problem resolution**
- **The fvtaclnk form lets you enter information about the stack trace, comments, and environment before it is sent via e-mail to TAC**

Core Switch

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FV TACLink is a GUI application provided with *ForeView* that helps the user of *ForeView* report problems back to FORE Systems' Technical Assistance Center (TAC). *ForeView* applications launch FV TACLink automatically when a "fatal error" occurs in the application. Alternatively, the user may launch FV TACLink directly from the command-line. FV TACLink allows the user to provide information about the *ForeView* user, and also retrieves information about the system on which *ForeView* is running. A user may select which pieces of information should not be included. The information that is gathered is automatically packaged by FV TACLink, and the user may choose to send the information directly to FORE Systems' Technical Support via email, or to save the information to file. The information is stored in clear text so that the user can inspect the information and make sure that no company-sensitive information is mistakenly sent to FORE Systems.

The information that FV TACLink gathers from the *ForeView* workstation is organized into 3 sections. First, there is *ForeView*-specific information, including the *ForeView* license file, the *ForeView* site-wide configuration file, *ForeView* version, etc. Second, there is Switch Topology information, which gives Technical support some information about the network that is being managed with *ForeView*. Finally, there is OpenView-specific information which is retrieved, including a database dump, local registration files, etc. A section for user comments exists so that the user can insert more information about what caused the fatal error to occur.

If a stacktrace file is not specified, the error.log file in /usr/fore/foreview/tmp directory is sent (as long as the environment variable FOREVIEW_HOME is set).

Selectable filter options (*ForeView* Specific, Network Topology, OpenView Specific) provide additional information to aid in troubleshooting your problems. In addition, use the Comments box to provide additional configuration information (SNMP configuration, software version, etc.).

fvtaclnk form

- **The fvtaclnk form lets you enter information about the stack trace, comments, and environment before it is sent via e-mail to FORE TAC**

Core Switch

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If a stacktrace file is not specified, the error.log file in /usr/fore/foreview/tmp directory is sent (as long as the environment variable FOREVIEW_HOME is set).

Selectable filter options (*ForeView* Specific, Network Topology, OpenView Specific) provide additional information to aid in troubleshooting your problems. In addition, use the Comments box to provide additional configuration information (SNMP configuration, software version, etc.)

Switch Troubleshooting Practice

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Both transmit and receive lights out on a netmod port always indicates a proper functioning port. True / False

2. The Channel Trace Tool provided with ForeView only traces a channel up until the point that its VPI/VCI changes. True / False

3. If one wanted to gather physical layer SONET error statistics, one would:
   a. Type the AMI command “statistics sonet”
   b. Type the AMI command “statistics port sonet”
   c. Select “Signaling” from the ForeView Port Control screen
   d. All of the above

4. A UPC contract may be applied to a connection which in so doing disables the application running over the connection. True / False

5. ILMI being on or off on a switch port has little to do with the LANE functionality on that port. True / False

Switch Troubleshooting (Answers)

(Total Time: 10 minutes Completion: 5 minutes Review: 5 minutes)

It is suggested that you try to complete this exercise from memory. However, if you need to consult your notes or the manual, feel free to do so.

---

1. Both transmit and receive lights out on a netmod port always indicates a proper functioning port. True / **False**

2. The Channel Trace Tool provided with ForeView only traces a channel up until the point that its VPI/VCI changes. True / **False**

3. If one wanted to gather physical layer SONET error statistics, one would:
   a. Type the AMI command “statistics sonet”
   b. **Type the AMI command “statistics port sonet”**
   c. Select “Signaling” from the ForeView Port Control screen
   d. All of the above

4. A UPC contract may be applied to a connection which in so doing disables the application running over the connection. **True** / False

5. ILMI being on or off on a switch port has little to do with the LANE functionality on that port. True / **False**